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SOME THOUGHTS ON THE TRAINING OF A RADIATION THERAPIST

JANEWAY LECTURE, 1951*

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I AM deeply sensible of the honor that has been bestowed upon me by being asked to give the annual Janeway Memorial Lecture before this Society. It is indeed a privilege to be chosen as a follower of the illustrious group of lecturers who have preceded me, each of whom has been a brilliant exponent of that part of the subject of radiation on which he or she chose to speak. I shall proceed, therefore, in all humility.

The memory of man is notoriously short, and shorter still is an appreciation of the painstaking and sometimes painful evolution on which our present fund of knowledge and skills is based. Without a Faraday, Maxwell and Henry, we would be without our electrical age; without a Becquerel and Curie we would have no concept of radioactivity, and without a Janeway we would be lacking our fund of knowledge regarding the use of interstitial application of radioactive substances for the care of malignant disease. Henry Harrington Janeway (1873–1921) was a man of broad medical interests and experience. Five years in general practice were followed by the practice of dermatology and the study of neoplastic disease. After being Chief in the Laboratory of Experimental Research of Physicians and Surgeons, he was, in about 1912, made Attending Surgeon and Chief of the Radium Department at Memorial Hospital. His scope of interest prior to this time had included cancer pathology, experimental work on blood pressure and shock and surgery of the esophagus and stomach. His interest soon turned to radiation, however, and to him we are indebted for first advocating radium as the primary treatment for carcinoma of the cervix, for being one of the first to recommend burial of radon in neoplastic tissue, and for the use of dental modelling compound. Glass radon capillaries were also developed in his laboratory. He was an indefatigable worker. I was not, as I presume is the case with most of us present on this occasion, privileged to know Dr. Janeway, but there is still much that can be learned from his work if we will but seek it. The broad base of his general medical and surgical training and his in-

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tense interest in all fields of medical practice give us a good background for our discussion this afternoon.

It is with some misgivings that I address you today on a subject regarding which many of you are much more capable of speaking than I. There are in this room many wiser, if not older, heads whose experience would more than justify their taking my place at this time. These remarks therefore are intended to be only thought provoking. They represent my personal thinking, as well as many thoughts obtained from my friends and peers, but I must accept sole responsibility for all of them.

I have chosen as the title of this address, "Some Thoughts on the Training of a Radiation Therapist." Before beginning this discussion it seems well to define what we shall consider together. Please note that the term I have chosen is "Radiation Therapist," although "Clinical Therapeutic Radiologist" would also suffice. This does not mean a physicist, it does not mean a research worker nor does it mean "an x-ray man." I have in mind the training of a well qualified, usually young physician, in all the aspects of radiation therapy. He must be able to consult and advise with his colleagues on cases which may or may not need therapeutic radiation and to reject those patients who have been referred to him for consideration of radiation treatment, but who will do better with some other form of therapy. In other words, he should be prepared to practice the highest type of clinical medicine with a special emphasis on radiation therapy.

I am sure that many in this audience, including the speaker, would like to have had a formal course of training in therapeutic radiology, under a man of his choice. Perhaps it is because my own formal course consisted of only two months that I have chosen to speak on this topic. As you can well see, therefore, I appreciate the position of those who wish to increase their experience and training in this branch of medicine. Such a training program is not a simple task but requires on the part of the preceptor all of the interest, application and ingenuity that he can muster.

It has been aptly stated that the most important part in the training of a candidate in any branch of medicine is the selection of the proper individual. This is even more true, I suspect, when considering therapeutic radiology, for not only must this man practice skillful medicine generally, as well as radiology, but he must be conversant with and incessantly practice the art of medicine which in therapy is also highly important. A likely candidate alone, however, is not enough and the best type of young therapeutic radiologist will not evolve by his own efforts. He must have a teacher, a councillor and guide who has a genuine interest in teaching; one who will give unstintingly of his time in the training program. The second important consideration, therefore, is the selection by the candidate of a preceptor who appreciates the opportunity which is afforded him—the teacher—in having young, inquiring and plastic minds always at his elbow. I may say in passing that it is not always the young man who gets the most training, especially if the chief or other staff member has not yet acquired cerebral stagnation and is only partly as anxious to learn as is the trainee.

At present there is a wise requirement of a year's internship before specialized training can be begun. Since the radiation therapist must have intimate contact with practically every branch of medicine, a rotating internship is probably better for him than a straight internship in medicine or surgery. Additional experience in some aspect of medicine, whether general practice, internal medicine, surgery or pediatrics will give him a concept of therapeutic problems that he will acquire more slowly, if at all, after specialization is begun. Under proper guidance, the opportunity of dealing with medical problems of a general nature gives a broad base of experience that is of great advantage to him in later years.

Also valuable to the budding young

therapist is some intensive training—full time—in a good department of pathology, where he is accepted as, and definitely is, an integral part of that department. Gross and microscopic pathology are important, not from the standpoint of attempting to make a pathologist of the man but to immerse him in the subject, to have him know how pathologists think and work and talk. To know what a pathologist means when he talks, to be able to ask intelligent questions and to talk to him in his own language is to acquire a working knowledge of morbid anatomy without which he cannot adequately understand the diseases and treat the patients who come to him for care. Six months of such study is valuable to a degree which depends upon the interest and application of the trainee. An added six months, at his desire, will be even more beneficial. More than just a casual or speaking acquaintance with pathology is, therefore, to be desired. Knowledge gained of how certain disease processes behave, how neoplasms spread and, later, how they respond to irradiation make his contacts with the pathologists mutually helpful. During this period he will also have the opportunity of studying irradiated tissue and acquire added respect for the radiations which he may well think are relatively harmless to normal structures. More than a modicum of training in pathology is, therefore, recommended but I think should not be made obligatory. Generally, however, the man with the greater amount of this basic training will go farther.

Since the science of therapeutic radiology is based on physics, it needs no clairvoyant to suggest that a thorough training in the physics of radiation is a sine qua non of the trainee's curriculum. Just how this is best accomplished is a moot question, however, and one on which there are several points of view and I think several answers. One of these is that there should be a formal course of lectures in radiation physics given by a physicist, with quizzess, examinations, grades, et cetera. I am sure that such a course can be of outstanding value, but I think only if it is given by a physicist who is intimately acquainted with the clinical therapeutic problems with which we must deal. The usual theoretical physicist does not have sufficient grounding in practical radiation physics nor acquaintanceship with clinical therapeutic problems to make adequate contact with the student of radiation therapy. Without that touch and insight, a course may become as sleep to weary eyes. No matter how good the physicist from a theoretical point of view, he cannot train a clinical therapeutic radiologist if he does not know intimately the practical problems dealing with radiations as we commonly use them. The significance of filters, the factors that affect scatter, depth dose, percentage depth dose and many other problems that confront us daily must be understood and have adequate coverage. To successfully give such a course, the lecturer must have more than the usual amount of charm and must present the material in such a way that the class will be constantly stimulated by application of theory to the daily therapeutic problems. Then, too, in my opinion, a theoretical course in itself, no matter how able the instructor, is not sufficient but must be supplemented by practical laboratory work in such problems as determination of intensity, quality, scatter, depth dose, etc., etc. Only by actually doing these things can a man come close to really understanding them. When it comes to problems in dosimetry in radium, radon and the isotopes, however, the trainee becomes even more dependent upon work done by experts. Such a course in physics should be given when a trainee is in the active part of his clinical therapeutic experience and is much to be preferred to having it given apart from actual daily therapeutic problems.

Unfortunately, however, many training centers, such as our own, do not have the advantage of a radiation physicist and are also not in a large community where such an individual can be utilized by a group of training departments. The responsibility for

training the residents or fellows devolves, therefore, on the local chief and his staff. Fortunately, those of us who find ourselves in this position now have invaluable aids in the form of books, graphs, charts and current articles from which to augment our meager knowledge of the subject and we consequently become the mouthpieces of those who really know. The correlation of this information with clinical actualities, however, is always—and should be—the responsibility of the local teaching group.

I should be on firm ground and facing a friendly audience when I say that the therapeutic radiologist, if he is going to be worthy of the appellation, must be thoroughly conversant with radioactive substances, especially radium and radon. One hears it said all too frequently that radium is now in the hands of the surgeon and gynecologist and why, therefore, should there be time spent in training our men and women in its use. "Radium is on the way out" is a statement that is also often heard, "so why waste time in teaching something, the value of which is rapidly waning?" One does not have to be an astute observer to realize that roentgen radiation can, has and should replace radium radiation in the treatment of a variety of conditions, but that there remains an irreducible number of lesions which are best treated by radium or radon seems irrefutable. Transvaginal roentgen irradiation in the hands of some well trained individuals has proved to be a valuable treatment for small primary carcinomas of the cervix. Is it not possible, however, that this form of treatment became popularized because certain radiologists were dissatisfied with the rule of thumb radium treatments that were being given and wished to give measured doses of radiation? Or may it not have been in some instances because the radiologist was himself uncertain about the use of radium and could therefore offer no constructive criticism? Certainly this type of treatment is better than radium given by rule of thumb or by correspondence. Are there still those who question the superiority of the use of radium or radon for carcinoma of the prostate, bladder, tongue, cervix, residual tumor of the tonsil or inoperable nodes in the neck, *to mention only a few?*

It cannot be disputed that some surgeons and gynecologists have become skillful and adept in the use of radium and treat their patients well. Many times the use of radium by these men has been necessitated by the inertia of the radiologists, and frequently these surgical specialists seek but cannot find adequate radiologic assistance. Even these physicians, however, would treat their patients more intelligently if they had the advice and cooperation of an interested radiologist, who was well trained in radium therapy. "Two heads are better than one" is an aphorism with considerable to commend it in the therapeutic approach to malignant disease and is nowhere more true than dealing with carcinoma of the cervix. Is it necessarily true that the pelvic examination of the gynecologist is more accurate than that of the radiologist? Or should the radiologist content himself with accepting his colleague's evaluation of the extent of the disease and proceed from there? Those of you who know me will immediately appreciate the answers that are in my mind. If the gynecologist does not have sufficient experience in radium dosimetry— and certainly most of them do not—it should be the part of the radiologist to ascertain whether the method being used is adequate or even approaches adequacy. In other words, he must be in a position to furnish basic advice even if he does not supply the mechanical skill. He should, however, also be able to actually place the radium.

The same holds true regarding the use of radium and radon about the head and neck. Some surgeons, after being helped with a few cases of interstitial radiation treatment, think that all that is involved is placing needles or seeds 1 centimeter apart and leaving the needles for five, six or seven days. They have no realization that the filtration, strength of foci and total amount of radioactive substance have a

great deal to do with the final dose. I am, of course, not speaking of the surgeons whose life work is the treatment of malignant disease and whose close association with the best physicists and radiologists has enabled them to acquire perhaps an even more adequate concept of this form of therapy than that of many of us. But these are surely in a small minority. The teaching approach to our trainee must, therefore, aim at making him conversant with all of the physical data referable to the use of the usual radioactive substances. Pertinent texts and current literature must be studied and the historical development of the subject should not be omitted. To have a working knowledge of the history of the development of a subject is to be more than half prepared. In the further elucidation of this part of radiation therapy, problems in dosimetry should be worked out and the trainee quizzed thereon. We now find that he can give us the half-life of a radioactive substance, the type of radiation emitted, the proper filtration and the number of roentgens given at any point in a theoretical mass. He may even know why the French use such amounts of radium in their containers as 1.3, 2.66 mg. rather than 1, 2 or 3 mg. But is this enough? To argue from analogy, would it be sufficient in training roentgen therapists to teach them physics, theoretical oncology, and have them read voluminously of pertinent texts and current literature and not require actual experience in setting up the treatment, checking the factors, observing reactions of skin and intestinal tract and generally being responsible for the patient in relation to the irradiation? I think the answer is obviously in the negative. Is it, therefore, perhaps not consistent to require our trainee in therapeutic radiology to have some practical experience with radium and radon application? It seems that this is not asking too much for one who is claiming or hopes to claim proficiency in therapeutic radiology.

The question immediately arises regarding how much actual practical experience in radium therapy should be required of those whom we train. And for this I have no glib reply. May it not be that an enthusiastic, well trained radium therapist can teach as adequately with a minimum number of patients as with a large number of cases that are not used to their full extent as teaching material? Is this not just as true as the teaching of roentgen therapy from a moderate number of well selected cases? Of course, one may even have to select some cases who can be equally well treated with roentgen rays but who are used for the teaching of radium techniques. The actual number of cases is in itself no criterion of adequacy of training, but if used carefully and fully it appears obvious that a man will be better trained if he has actually treated twenty patients than if he has only seen five treated. The paucity of radium cases in many institutions is, I think, in no small measure due to the fact that roentgen therapy requires, on the whole, less time and patience than a skillful application of radium which can never be left to the technician. At times, it seems almost as though this problem resolves itself to this, viz., do we as teachers understand and regard highly enough the use of radium to put ourselves out and take the time to teach it? The answer in many instances is obviously "no." I would not for a moment wish anyone to think that these remarks are being made ex cathedra. It is because in our department we have succumbed to the same temptations for short-cutting which beset all busy institutions that I sympathize most deeply with those who face the problem as it also confronts us. But is there a thoughtful and sincere therapist who does not admit that certain selected lesions are better treated with radium than with roentgen rays? The number may not be a large percentage of all cases, but I am convinced that careful scrutiny will reveal a rise in the slope of the curve rather than a continued fall, for those who can and do use the treatment most suited to the case.

It is to be unrealistic to expect a trainee

in therapeutic radiology to excel his colleagues in all uses of radiant energy—and by this I refer to the use of artificial radioactive isotopes, particularly in investigation. The research worker in biochemistry, for example, will always know more about his problems and the use of isotopes in their solution than can a therapeutic radiologist. And the same is true of biophysicists, internists, surgeons, and others, but their knowledge of the basic concepts will almost always be different from that of the trained radiologist who will know more of the biologic effects, the safe personnel dose, and the protective measures to be used. His training in this field, therefore, will be of a more general nature with points of specific emphasis where the use of these substances touches clinical therapeutic problems. Examples of what I have in mind are the use of I^{131} in benign and malignant thyroid disease, P^{32} in leukemia and polycythemia, and colloidal Au^{198} in widespread ovarian neoplasms or carcinoma of the prostate and breast. The advice of a well known surgeon to a general medical audience, "Just give each case of hyperthyroid disease 7 millicuries of I^{131}" is scarcely to be recommended. This approach to the use of isotopes need form no barrier to further study of detection and protection, or the pursuit of specific problems in which the young radiologist may be interested.

Since the efforts of therapeutic radiologists are directed toward affecting living tissue with radiations, the importance of the study of radiobiology becomes immediately apparent. If a trained and cooperative radiobiologist is available, a few well chosen lectures are of great aid. If not, those responsible for the training must accept this as part of their program. Again, we are not training radiobiologic specialists, but we cannot afford to miss the opportunity of teaching the subject by close scrutiny of cutaneous, intestinal, hematologic, chondral or osseous reactions to our therapy. And, of course, careful observations of the response of the neoplasms that we treat must be an integral part of every therapist's routine.

Another important aspect of training is the day to day care of patients during their course of treatment. Here the young man learns under careful supervision how to set up the treatments, size of fields, allowable daily dose and the reactions that may ensue. Here, too, he finds that pre-irradiation prognosis should be given guardedly, since one may be surprised in either direction. During this time he likewise increases his skill in determining the extent of pelvic disease or involvement of structures in the head and neck, or about the breast, and begins under supervision to use interstitial radiations in a tongue or to apply radium to a cervix after preliminary dilatation.

One of the most important aspects of scientific medicine is the attempt to judge accurately cause and effect. In therapeutic radiology we must be careful to hew to the line in this regard. Who of us has not had dire sequelae of any from of care imputed to radiation simply because the patient had been in the room with a roentgen-ray machine, as it were? We naturally dissent when our radiations are blamed for non-healing mastectomy wounds, when irradiated giant cell tumors become malignant or were not so recognized at the outset, and when a febrile reaction in an irradiated patient is attributed to the irradiation. But are we equally objective when we accept the credit for all improvement which occurs during or following irradiation? In a specialty such as ours with its inherent veil of mysteriousness, who can remain free from such errors without constant vigilance? And, who has not remarked an excellent result following the treatment of a hopeless tumor only to find out that there was never microscopic evidence of the malignant nature of the disease and that it was in all probability inflammatory from the outset? These attitudes of strict intellectual honesty can never be taught as such, but they can be displayed quietly for the trainee to see. We teach most of the art and much of the scientific attitude by example rather than by didactic lecture.

We now have a man surfeited with medicine, pathology, physics, radiobiology and the techniques of clinical therapeutic radiology, including roentgen rays and radium, and with some idea of the general problems which confront one interested in the treatment of malignant disease. Some things yet he may lack. He still is "as sounding brass" unless there be the development of "the milk of human kindness," judgment, tact and gentleness of spirit and manner which mean so much to those under our care for neoplastic disease. The science of therapeutic radiology is indeed important, and adequate care of patients by irradiation cannot be realized without it. In fact, to attempt to do so is to approach the charlatanic. On the contrary, the understanding of the psychic make-up and status of a patient with curable and incurable malignant disease may make the difference between success and failure in the care of specific patients. In the press of work of a busy department it is easy to lose sight of the fact that we are dealing with patients —men, women and children—most of whom feel, think and act as we would under similar conditions. On second thought, how many of us would comport ourselves half as well as most of our patients with malignant tumors? A buoyant, kindly and hopeful attitude does much to reassure them. After all, the main hope of many is with the radiologist. This attitude of hope and kindliness must be transmitted from preceptor to trainee by example, than which there is no more powerful force in teaching.

While all of these processes are under way and while he is studying malignant diseases, physics, radiobiology, etc., the trainee is initiated into the raison d'être of the whole procedure. That is, the care of sick people whom he can, or has a reason to think he can, benefit by his treatments. Here is where the art of medicine begins for him in his new life, as on him will come to rest the hopes and even lives of many otherwise hopeless patients. This period of the training is of great importance and the trainee should be taught to give the same kindly thought and care to all patients regardless of financial or social position.

Learning the techniques of roentgen and radium therapy are in themselves important, but are relatively meaningless to the radiologist if he does not follow the condition of the patients carefully and find out what transpired after the treatment was concluded. An active part in the follow-up examinations of irradiated patients is therefore part of a well organized training program. Pelvic examination on patients he has treated will mean far more a few months post-irradiation than at the time treatment was actually given. What he learns will be the basis of all of his thinking on the subject when he begins to practice "outside the nest." Eager though he may be to benefit the patients who come under his care, he must be made to realize that there are some conditions which he cannot expect to improve and that enthusiasm must not turn to folly. Care must be taken not to make a patient worse and especially should the trainee be taught gentleness of care for the aged.

None of us is, I hope, naive enough to think that he can give complete knowledge of the problem of radiation therapy to those who come under his supervision nor must he forget that some of the trainees may excel their teachers in many aspects of the subject. Our part in the program is to point the man in the right direction, to ground him firmly in the basic principles on which rest the whole concept of radiation therapy and to establish firmly in him the highest regard for good medical practice. How far he will go—not how much money he will make—will depend, first, on his own initiative and character, and second, on the success of our attempts to guide him. Let us hope that we do not fail in our part of the program.

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SYMMETRICAL CALCIFICATIONS IN THE ANTERIOR LIMB OF THE INTERNAL CAPSULES OF THE BRAIN WITHOUT DEMONSTRABLE NEUROLOGICAL OR METABOLIC DISTURBANCES*

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INTRACRANIAL calcifications demonstrable in roentgenograms of the skull can be demonstrated in various parts of the brain and other intracranial structures under a variety of conditions. Ossification in the dura mater, particularly the falx cerebri, and calcification in the pineal body, the choroid plexuses and the petroclinoid ligaments are of such common occurrence as to be almost normal developments. Calcific deposits are also commonly seen within the brain itself as the result of toxoplasmic encephalitis, cysticercosis, trichinosis, tuberous sclerosis, angiomas, gliomas, and other neoplasms. Diffusely scattered areas of calcification have also been described in the brains of mentally deficient individuals. Calcification in the brain under such circumstances has been observed in siblings or otherwise related persons (Fritzsche[7]). Among the areas involved by calcium deposits in these feebleminded patients are the basal ganglia. But calcification of the basal ganglia alone or in connection with areas of calcification elsewhere in the brain may occur without demonstrable cause and without associated neurological symptoms or in association with parathyroid insufficiency. Such intracerebral calcification has particularly stimulated the interest of Camp and his associates at the Mayo Clinic and has occasioned the publication of a number of papers.[2,3,4,5,6,9] In his latest papers Camp has assembled 12 cases of symmetrical calcification of the basal ganglia with definite evidence of parathyroid insufficiency and tetany.[2,3] In 11 instances the parathyroid deficiency was of a spontaneous nature; in 1 it resulted from a thyroidectomy. In 5 of his cases there were other areas of calcification elsewhere in the cerebrum and cerebellum.

Few pathological examinations of brains with calcification of the basal ganglia have been made. However, in those specimens which have been studied it has been commonly thought that the calcification had developed in relation to the smaller blood vessels of the brain (Fritzsche; Kasanin and Crank;[8] Camp). In view of the appearance of the areas of calcification which has been seen in our case it is noteworthy that no one has observed any calcification in the region of the internal capsule. However, the number of observations made thus far has been too small to be conclusive on this point.

That symmetrical calcifications could develop in the brain in the region of the basal ganglia and the internal capsules without any neurological symptoms or findings on examination was unexpectedly brought to our attention by the following case. It illustrates that although such calcifications may be seen in patients suffering from familial forms of mental retardation or from parathyroid insufficiency, either with or without mental alterations, such need not be the case.

CASE REPORT

W.E.D., a white male, aged forty-three, of Lithuanian extraction, was admitted to The Chicago Memorial Hospital on the service of one of us (P.C.B.) on September 11, 1945, because of a minor head injury. He had not been unconscious and the only injury was a laceration of the scalp. Roentgenological exami-

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nation of the skull revealed no bony injury, but unusual symmetrical intracranial calcifications were present (*vide infra*). Because of this, he was asked to return to the hospital a few days later for further examination. He had no complaints and no history of previous neurological disorders except that for the past several years he had suffered from headaches of about five hours' duration every four or five months. He had known of an arterial hypertension for the past several years. He was divorced from his first wife and separated from his second. He was addicted to alcoholic debauches of four or five days' duration every few months. He had held his present job for three years, but previously changed jobs every nine to twelve months. He had had the usual diseases of childhood but no other illnesses except gonorrhea. He had sustained a laceration of the scalp in 1925 with no evidence of intracranial injury. His father was living and had suffered from a stroke eleven years before. His mother was living and said to be psychoneurotic. There were no other neurological disorders in the family.

Examination disclosed an alert, cooperative, obese man 5 feet and 7 inches tall, weighing 245 pounds. The general physical examination was negative apart from the obesity and an arterial hypertension of 180/110. His speech, memory and intelligence seemed normal. The optic discs and retinae were normal. The cranial nerves, sensation in all forms and muscular strength, tone and coordination were all normal. There were no involuntary movements. The tendon reflexes were all normally active and equal. The abdominal reflexes were absent, but he was very obese. Babinski's sign was not present and his station and gait were normal.

Routine laboratory examinations of the urine and blood, including a Wassermann test, as well as serum calcium and phosphorus determinations, were all normal.

The roentgenological examinations of the skull (Fig. 1 and 2) showed normal appearances of the bones without evidence of any fracture. The pineal body, which was calcified, was in normal position. There were symmetrical calcifications in the anterior portion of the brain. These were located about one-third the distance from the midline to the inner table of the skull in the expected plane of the coronal suture and about one-fourth the distance from the floor of the skull to the vertex. In the posteroanterior view these calcifications were grouped on each side in a somewhat striated band about 0.5 cm. wide and 2.5 cm. long. These bands, running slightly obliquely, tended to converge inferiorly. In fact, imaginary extensions of these bands would have converged in a V at the level of the base of the frontal sinuses. In the lateral view there was seen a more or less circular arrangement of punctate calcifications.

Fig. 1. Posteroanterior projection of skull showing symmetrical calcifications in region of caudate nuclei.

Fig. 2. Same in lateral projection.

Because of the location of these areas of calcification in the anterior portion of the brain, their symmetrical position on either side of the midline extending downward and inward, converging inferiorly, and their striated appearance in the posteroanterior view of the skull, we postulated that this

calcification was in the anterior limb of the internal capsule. These striated bands of calcification correspond quite closely to the striated bands of grey matter which pass between the fibers of the anterior limb of the internal capsule connecting the head of the caudate nucleus with the putamen. It certainly seems most likely, from this view of the skull, that the areas of calcification lie between the head of the caudate nucleus and the lenticular nucleus (the putamen and the globus pallidus). In the lateral view, as is noted above, the areas of calcification are arranged more or less circularly and correspond quite closely to the shape and position of the head of the caudate nucleus. No other structure in this portion of the brain has such a V-shaped appearance as does the anterior limb of the internal capsule.

Inasmuch as this interpretation seemed in disagreement with the observations made by Camp and his associates, we asked him to examine our films and comment upon them. After reviewing our material, Camp[10] is of the opinion that the calcifications are in the basal ganglia rather than the internal capsules and cites as evidence in support of this view the fact that postmortem examination of the brain in one of his previously published cases reveals no evidence of any calcifications in the internal capsules. Only calcifications in the basal ganglia were present. Furthermore, Beyme,[1] who has also studied the brain in a case of symmetrical calcifications in this region, noted involvement, principally of the basal ganglia (the putamen and globus pallidus) and the lateral part of the thalamus. However, he did find microscopic areas of calcification in the anterior part of the internal capsule, in the claustrum and in the white matter of the cerebrum.

It is obvious, however, that the amount of factual evidence upon the location of the calcification in such areas is far too limited to be conclusive. Obviously the exact location of the calcific deposits in our case must, for the present, remain a matter for conjecture. Nevertheless, it seems most likely to us that the calcification has occurred in the small interconnecting bits of grey matter of the striatum which lie in the anterior limb of the internal capsule and connect the caudate nucleus and the putamen. Thus, it is likely that both Camp and we are correct. The calcification is in tissue of the basal ganglia but tissue which lies among the fibers of the internal capsule.

The cause and, therefore, the significance of these areas of symmetrical calcification in these highly selective areas are unknown. We would agree with Camp that although such calcifications may occur, as in this case, without signs or symptoms other than the roentgenographic appearance, their discovery should lead to a detailed investigation of parathyroid function.

SUMMARY

A case is reported in which roentgenological examination of the skull after a minor trauma revealed, as an incidental finding, symmetrical calcifications located in the region of the anterior limbs of the internal capsules, between the caudate nucleus and the putamen.

No neurological abnormalities were found and there was no evidence of impaired mentality. Clinical and laboratory examinations showed no evidence of parathyroid insufficiency.

The importance of this uncommon roentgenographic finding is, as emphasized by Camp, that it may be associated with mental retardation due to hypoparathyroidism. Therefore, the roentgenological observation of symmetrical calcifications in the basal ganglia should lead to clinical and laboratory studies to exclude parathyroid insufficiency. If parathyroid insufficiency is found, it may be possible to salvage by appropriate treatment an occasional mentally retarded individual or prevent the development of symptoms in an individual with hypoparathyroidism alone.

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ADVANCED ATROPHY AND ENLARGEMENT OF THE SELLA TURCICA WITH DESTRUCTION OF THE SPHENOID*

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THE roentgenographic appearance of the sella turcica often serves as a sensitive barometer of conditions within the cranial cavity. Atrophy of the sella and enlargement of its fossa is a frequent accompaniment of space-occupying intracranial lesions, both intrasellar and extrasellar in location. However, pronounced enlargement, severe atrophy up to the point of its complete disappearance, and actual bone destruction is less common. Such changes may occur in a wide variety of pathologic conditions which may, nevertheless, present certain common clinical features in addition to the advanced sellar changes. Out of a large material available to the authors, 50 cases of tumors within or near the sella turcica have been selected, each showing pronounced sellar changes. The pathologic processes responsible for these changes in our cases, as well as those in cases from the literature with conditions in or near the sella not present in our series, are listed in Table 1.

TABLE I

Author's Material	*Cases*
1. Pituitary adenomas (only cases with advanced sellar destruction or atrophy, disappearance of the dorsum sellae, floor and variable portions of the anterior wall of the sella were included. Cases with typical ballooning were excluded)	28
2. Intrasellar craniopharyngiomas	6
3. Aneurysms of the internal carotid artery	4
4. Lympho-epitheliomas with sphenoid destruction	2
5. Carcinoma of sinuses or nasopharynx	1
6. Nasopharyngeal lymphosarcoma	1
7. Primary sarcoma of the sphenoid	1
8. Ependymoma of frontal fossa invading sella	1
9. Metastases from distant sites (breast—4, prostate—1, kidney—1)	6
From the Literature	
10. Chordoma[1,6,11,12]	
11. Neurofibromatosis[15,21]	
12. Intrasellar meningioma[16]	
13. Giant cell tumor of the sphenoid[9]	
14. Malignant adenomas of the chromophile cells of the pituitary body[3,14]	
15. Pituitary abscess[25]	
16. Osteomyelitis, syphilis, tuberculosis[20]	

For purposes of comparison, cases with advanced sellar changes due to lesions removed from the sella turcica were reviewed. These included 10 cases of advanced sellar atrophy due to hemispheral neoplasms, including 4 cases of parietal glioblastoma multiforme, 2 cases of undifferentiated frontal glioma, 2 cases of parasagittal meningioma and 2 cases of temporoparietal glioblastoma multiforme. Ten additional cases of advanced sellar atrophy due to pronounced dilatation of the third ventricle were also reviewed. These included 3 pinealomas, 2 third ventricle gliomas, 2 with stenosis of the aqueduct of Sylvius, and 3 posterior fossa tumors including a midline cerebellar astrocytoma, a cerebellar hemangioblastoma and an acoustic neuroma.

LITERATURE

The characteristic ballooning of the sella turcica caused by pituitary adenomas is well known. Kornblum and Osmond[17] men-

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tioned that in addition to the usual changes intrasellar neoplasms may occasionally produce erosion of the floor of the sella turcica. Scheuermann[22] also pointed out that changes in the pituitary fossa associated with chromophobe adenomas might be extensive. An unusually large pituitary adenoma was reported by White and Warren.[28] An intrasellar meningioma which so expanded the sella turcica that a diagnosis of pituitary adenoma was considered was described by Kirschbaum.[16]

Pronounced sellar enlargement associated with craniopharyngioma was recorded by McKenzie and Sosman,[19] Frazier and Alpers,[13] and Young.[29] Drummond[8] published a striking example of sphenoid destruction extending to the apices of the petrous pyramids in a fourteen year old girl with an infrasellar adamantinoma which protruded upwards.

Sphenoid destruction due to metastatic tumors from the breast and from a retroperitoneal sarcoma was observed by Camp.[4] Kornblum and Osmond[17] described a case of carcinoma of the sphenoid sinus causing similar destruction, and von Poswik[27] recorded a case of destruction of the dorsum sellae by what was believed to be a sphenoidal or nasopharyngeal carcinoma invading the base of the skull. Reossification followed deep roentgen therapy in her case.

Sphenoidal destruction incident to neurofibromatosis was described by Peyton and Simmons[21] and by Holt and Wright.[15] Alpers and Forster[2] reported a case of arteriovenous aneurysm of the great cerebral veins and the arteries of the circle of Willis resulting in complete disruption of the dorsum sellae and posterior clinoids with apparent enlargement of the hypophyseal fossa. Calcification was present in the walls of the aneurysm, and ventriculography disclosed marked dilatation of the ventricular system. Other examples of sphenoid destruction due to aneurysms of the internal carotid artery were reported by Lodge, Walker and Stewart[18] and by Zollinger and Cutler.[30]

Epple and Ruckensteiner[11] divided chordomas into benign and malignant types, declaring that the clivus may be destroyed by the latter. Cantor and Stern,[6] Farberor,[12] and Selinsky[23] reported sphenoid changes due to chordomas.

Echols[9] described a case in which a giant cell tumor of the sphenoid resulted in obliteration of the sella turcica, suggesting to him either a cerebellar tumor or a large pituitary adenoma.

An abscess within the sella turcica causing an appearance consistent with a pituitary adenoma was described by Svien and Love.[25] Deformities of the walls of the pituitary fossa secondary to osteomyelitis, syphilis or rarely tuberculosis is mentioned by Pancoast, Pendergrass and Schaeffer.[20]

The effect of intrusion of the anteroinferior aspect of a dilated third ventricle into the hypophyseal fossa was described by Twining.[26] He believed that contact between this chamber and the pituitary gland may result in the ultimate destruction of the hypophyseal fossa. In a discussion of the effects of obstruction of the cerebrospinal fluid circulation at or beyond the sylvian aqueduct, Shelden, Parker and Kernohan[24] mentioned that in 6 of their cases the plain skull films showed sellar changes varying from normal to almost complete destruction.

The causes for changes in the sella turcica due to increased intracranial pressure has been considered in relationship to pressure of an adjacent tumor mass, pulsations in the adjacent vessels, particularly the internal carotid arteries, or as a reflection of the diffusely increased intracranial pressure accompanying either cerebral edema or hydrocephalus. The reversibility of sellar atrophy was noted by Davidoff[7] in a patient with a cerebellar tumor in whom the bony densities returned to normal after relief of hydrocephalus. Ecker[10] reported a case of cerebellar tumor with destruction of the posterior clinoids, enlargement of the sella and erosion of the anterior clinoids suggesting an intrasellar tumor. On the basis of pneumoencephalograms and cerebral arteriograms in this case, he suggested

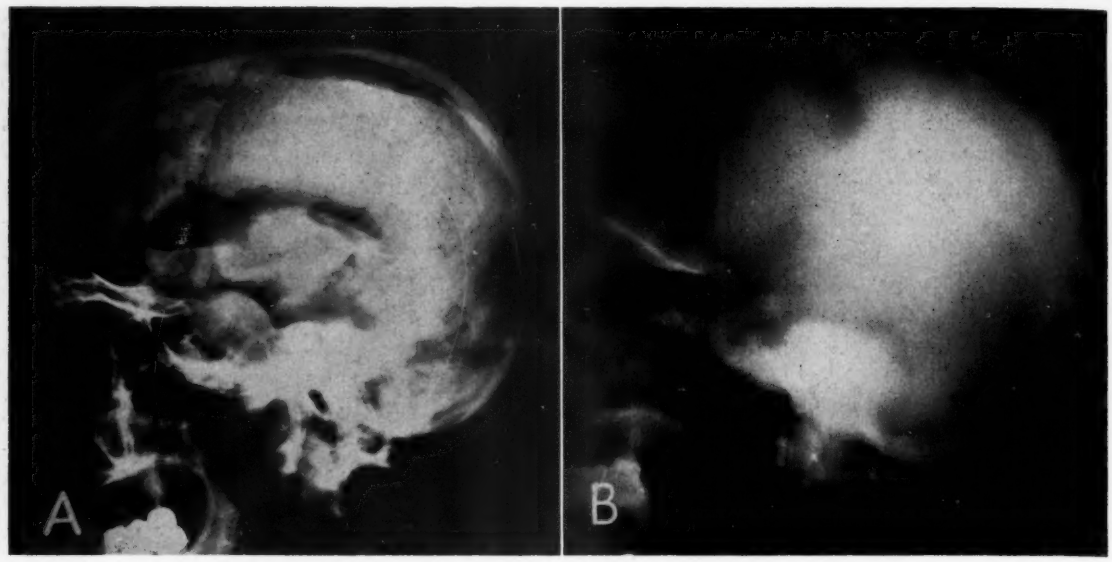

FIG. 1. Case I. (*A*) Lateral pneumoencephalogram revealing a soft tissue mass protruding into the cisterna interpeduncularis from a destroyed sella turcica. The anterior wall and anterior clinoid processes appear decalcified but intact. No dilatation of the lateral ventricles is present. Chromophobe pituitary adenoma. (*B*) Lateral midline laminagram revealing extensive destruction of the sella turcica and sphenoid, involving all the confines of the hypophyseal fossa. A remnant of the dorsum sellae persists, revealing a rather granular type of destruction of this structure.

that the bone changes were due to block of the sylvian aqueduct with consequent hydrocephalus. This in turn caused elevation of the anterior and middle cerebral arteries and upward traction of the terminal portions of the internal carotid arteries. The pounding of the latter, according to him, eroded the anteromedial aspect of the anterior clinoid processes. Camp[5] recently reiterated the importance of observing the sella turcica as an index of changing intracerebral conditions.

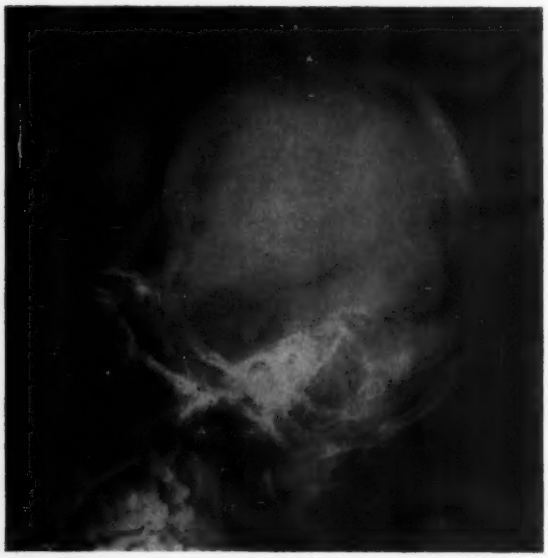

FIG. 2. Case II. Lateral roentgenogram revealing complete absence of the entire sella turcica, including the anterior clinoid processes. Chromophobe pituitary adenoma.

CASE REPORTS

CASE I. J.G., male, aged fifty-six, had headache, nausea, vomiting and transient diplopia for six weeks. Abnormal physical changes were limited to his eyes, which presented normal fundi and pupils, but in which movement of the right eye to the right, laterally, superiorly or inferiorly was not possible.

Plain skull roentgenograms revealed extensive destruction of the posterior clinoids and the floor of the sella turcica. A midline laminagram showed this destruction to extend into the anterior wall of the hypophyseal fossa. The destruction was of a granular nature, suggesting to the roentgenologist either a chordoma or a metastatic tumor. Pneumoencephalography disclosed a soft tissue mass extending into the cisterna interpeduncularis from the sella turcica. The lateral ventricles were neither deformed nor displaced.

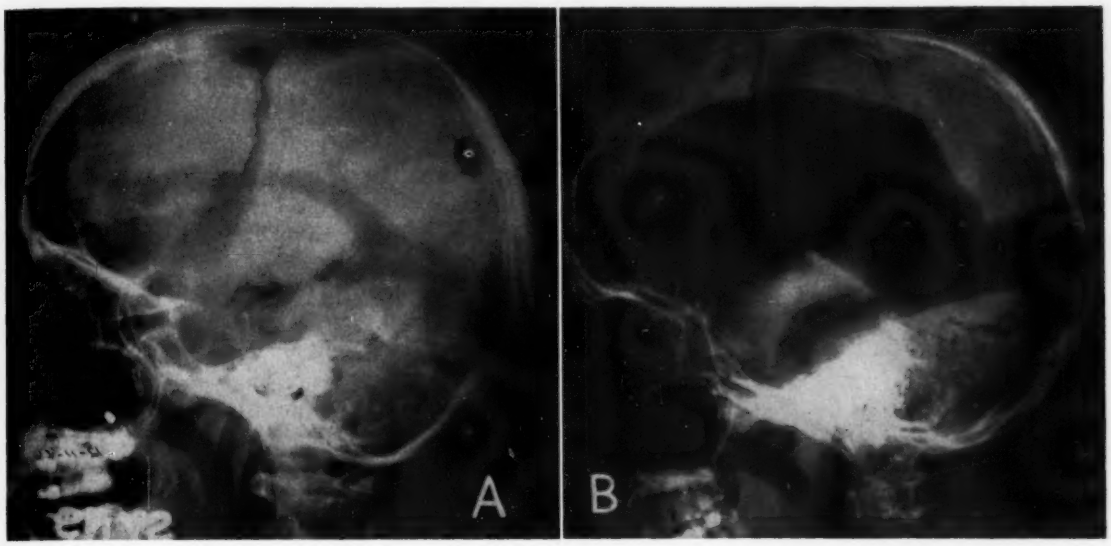

Fig. 3. Case III. (*A*) Lateral pneumoencephalogram revealing normal lateral ventricles. The sella turcica is markedly enlarged, hemispherical in configuration, and presents atrophic walls dorsally. Craniopharyngioma.

(*B*) Another carniopharyngioma in the present series revealing advanced dilatation of the lateral ventricles due to blockage of the foramen of Monro by the tumor. The sella turcica is no longer visible, only the anterior clinoid processes remaining.

At operation the optic nerves were seen to be flattened by a dark reddish-brown tumor. Its capsule was incised and the contents removed with a curet. Histopathologic examination revealed chromophobe pituitary adenoma.

The patient received deep roentgen therapy during the next two and one-half years with some apparent benefit. Repeated roentgenographic examinations showed no change in the appearance of the sphenoid bone. Lately his vision has deteriorated to the point of almost complete blindness.

Case II. L.H., male, aged twenty-nine, complained of severe headache and occasional vomiting for nine months. His vision had failed for three months. Physical examination disclosed impairment of visual acuity in his right eye but no other positive findings.

Plain roentgenographic examination of his skull revealed advanced atrophy of the entire sella turcica, only the anterior clinoid processes remaining visible. These, as well as the lesser wings of the sphenoid, were decalcified. The superior orbital fissures on both sides were widened.

At operation a large encapsulated tumor was brought into view by retracting the frontal lobe. This was incised and considerable soft tissue of a reddish, friable nature was removed by suction and curettage. Microscopic examination revealed a pituitary adenoma of a mixed type.

Case III. F.S., a boy, aged ten, had had left-sided parietal headaches without nausea or vomiting for about nine months. Some impairment of vision in his right eye was noted two months ago, the patient complaining that he could not see well on his temporal side. This was followed by polydipsia, but no polyuria was noted. He also tended to have a rather high fever with the slightest infection.

Physical examination showed the visual acuity of his right eye to be markedly decreased, and a moderately large right paracentral scotoma was identified on confrontation tests. The fundi were normal, aside from rather full veins. There was minimal weakness of the right lower limb, but no reflex changes.

Plain roentgenograms of the skull revealed the sella turcica to be markedly enlarged, presenting a semicircular contour. Pneumoencephalography showed neither dilatation nor displacement of the lateral ventricles, and the basilar cisterns were not disturbed. No unusual calcifications were present. It was believed that a pituitary adenoma might be present.

At operation a large cyst protruding from the sella turcica was evacuated and about two-

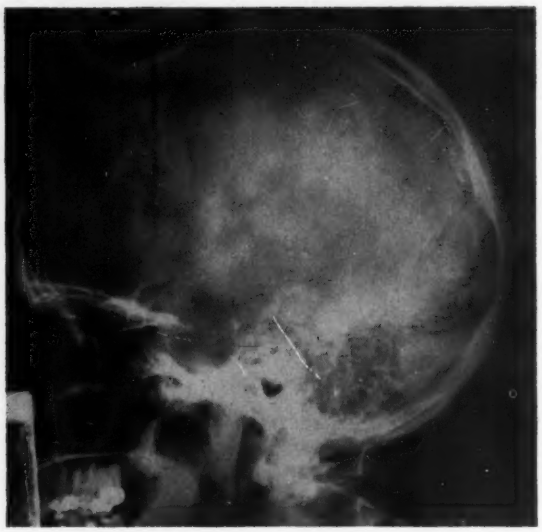

FIG. 4. Case IV. Lateral roentgenogram of the skull revealing ballooning of the sella turcica with marked atrophy of the floor and dorsal displacement of the dorsum sellae. Metastases from nasopharyngeal or paranasal sinus carcinoma simulating pituitary adenoma.

thirds of the cyst wall was removed. Histopathologic examination showed this to be a craniopharyngioma. The patient responded well to treatment.

CASE IV. E.H., male, aged twenty-six, first complained of blurred vision for laterally placed objects about eighteen months before he consulted us. There was a sense of ocular fatigue which was not relieved by glasses. His vision remained unchanged for about five months, when he noted that he collided with moving objects on his left side. There were no other complaints. Physical examination disclosed no changes other than bitemporal hemianopsia, slight pallor of both optic discs and diminution of vision.

Plain roentgenograms of the skull showed marked enlargement of the sella turcica with destruction of its floor and anterior wall. The anterior and posterior clinoids were intact but decalcified, and the posterior clinoids were displaced dorsally. The diagnosis was pituitary adenoma.

Deep roentgen therapy was begun but the visual fields continued to shrink. Transfrontal craniotomy was performed and a tense, cystic, bluish tumor was found in the sellar region stretching and flattening the optic nerves and chiasm. This was punctured and about 60 cc. of dark brown fluid evacuated. A biopsy of the cyst wall was taken and reported as metastatic adenocarcinoma of the pituitary, probably primary in the accessory nasal sinuses or nasopharynx. The cells were arranged around endothelial lined spaces which were circular or elongated and resembled columnar epithelium, which in some places bore ciliary processes.

FIG. 5. Case V. Lateral midline laminagram revealing complete destruction of the entire sphenoid bone including the sella turcica. Sarcoma of sphenoid.

CASE V. J.K., male, aged six, complained of headaches, twitching of the right side of the mouth, pain in the right ear and pain on turning his head towards the right. This had been gradual in onset over a period of three months. Physical examination disclosed paralysis of the right external rectus eye muscle. About two weeks later, bilateral paralysis of the fourth and sixth cranial nerves appeared, followed by ptosis of the right eyelid. Examination of the fundi showed blurring of both optic discs, but no other changes. Neurological examination was otherwise negative.

Plain roentgenograms of the skull revealed a rapidly progressive destruction of the sphenoid bone. At the initial examination only the dorsum sellae was involved, with the floor of the sella remaining intact. Within six weeks the entire sphenoid bone vanished. Pneumoencephalography showed no ventricular dilatation but a soft tissue mass protruding from the sella turcica into the cisterna interpeduncularis was present.

At necropsy a tremendous sarcoma involving

the base of the skull destroying the sphenoid bone and pituitary gland was found. This extended into the nasopharynx. Roentgenographic examination of the removed specimen showed only fragments and spicules of bone imbedded in the neoplastic mass.

Case vi. S.K., female, aged forty-eight, had complained of headaches for five years, and dimness of vision of the right eye, which had slowly progressed to almost complete blindness, had been present for seven years. Physical examination showed only primary optic atrophy and blindness of the right eye. The left optic disc was blurred.

Plain roentgenograms of the skull showed almost complete destruction of the sella turcica, only a thin delicate rim of bone remaining posterior to the usual position of the posterior clinoids. The diagnosis was intrasellar tumor.

At operation, a large tumor springing from the base of the brain was encountered. This involved the inferior aspect of both frontal lobes and extended into the sella turcica. In places the tumor appeared to have a capsule and to be separable from brain tissue, and in other places it infiltrated the brain. Histopathologic examination of the removed tissue revealed ependymoma. The patient died two days later.

Fig. 6. Case vi. Lateral skull roentgenogram revealing pronounced enlargement and atrophy of the sella turcica. Frontal ependymoma extending into sella at operation.

Case vii. E.M., male, aged sixty-four, complained of headache and inability to move his right eye for three weeks. About that time he observed that his right eye was prominent. Enlargement of the right testicle was noted three days before admission. He vomited several times during the two days before he entered the hospital.

Physical examination disclosed a complete right external and internal ophthalmoplegia. The right pupil was dilated and fixed. Both optic discs showed nasal blurring. An abdominal mass about 15 cm. in diameter was felt in the

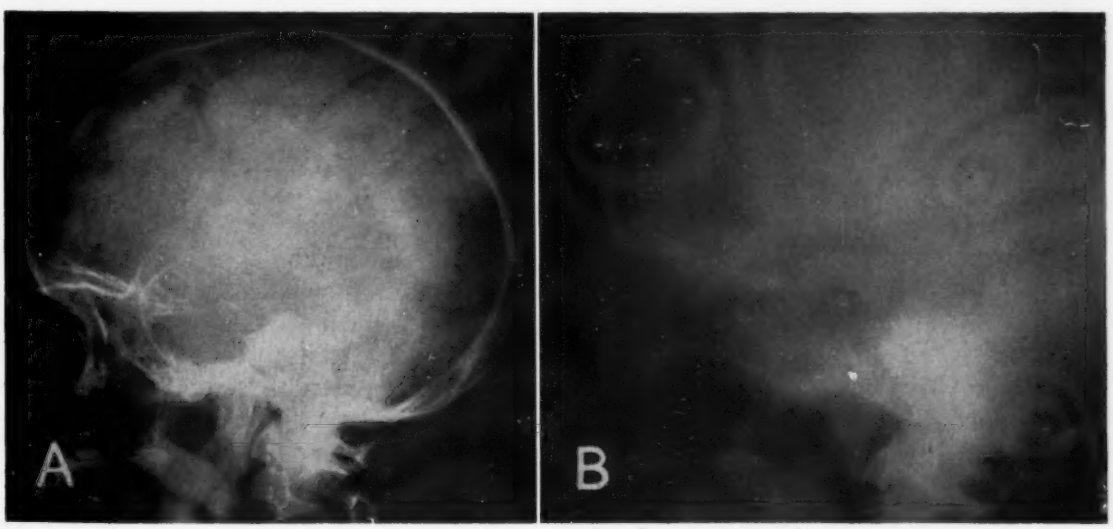

Fig. 7. Case vii. Lateral skull roentgenogram showing advanced destruction of the sella turcica and body of the sphenoid bone. The ghost of the posterior clinoids remain in their approximate normal position. Metastatic lymphosarcoma. (*B*) Midline laminagram showing degree of destruction in better detail.

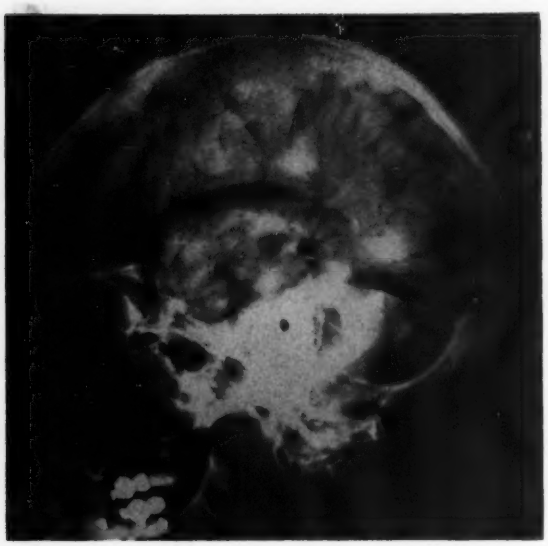

FIG. 8. Lateral pneumoencephalogram showing mass projecting from destroyed sella turcica into cisterna interpeduncularis. Aneurysm of internal carotid artery at operation.

right lower quadrant, and a right hydrocele was present.

Plain roentgenograms of the skull revealed extensive destruction of the sella turcica and sphenoid. The lesser wings of the sphenoid were moderately decalcified. A kidney tumor was identified by intravenous urography on the right side, and a small metastatic deposit was found in the posterior aspect of the left fourth rib.

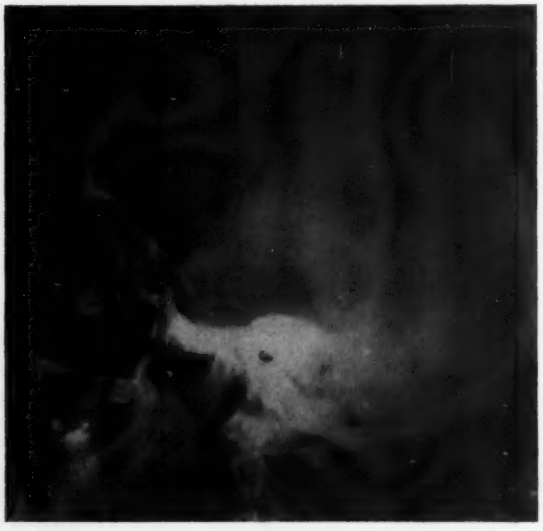

FIG. 9. Lateral film of skull showing advanced destruction of sella turcica. Pineal body displaced posteriorly and downward. In anteroposterior view pineal was displaced sharply toward the right, indicating the hemispheral localization of the tumor. Parasagittal meningioma at operation.

The patient became uremic and died three weeks after admission. Necropsy disclosed a lymphosarcoma involving both kidneys, both adrenals, the wall of the inferior vena cava, the pericardium and the sphenoid bone and pituitary gland. Sections made through the sphenoid showed the marrow spaces and surrounding tissues to be invaded with lymphosarcoma cells.

COMMENT

The clinical syndrome associated with sellar and sphenoidal destruction was fairly uniform in our cases where the process was not due to hemispheral or cerebellar tumors or dilatation of the third ventricle. Most prominent was diminution of vision with temporal field defects, which was usually insidious in onset and progressive to blindness in one or both eyes. Headache of variable intensity and duration was often observed. Drowsiness was noted in some patients with hydrocephalus caused by blockage of the foramen of Monro, as occurred with large extrasellar pituitary adenomas or craniopharyngiomas. Vomiting sometimes occurred, and dizziness and difficulty in walking was mentioned by a few patients. Those with lymphoepithelioma, nasopharyngeal lymphoblastoma or sarcoma of the sphenoid bone in whom the tumor had invaded the nasopharynx complained of throat pain. Symptoms referable to the adjacent cranial nerves were encountered in 3 patients with extensive bony destruction.

Evidences of endocrine dysfunction were relatively uncommon even in patients with primary pituitary adenomas. There were 32 cases in which the clinical histories were of sufficient detail to include mention of changes in menstruation, body weight, distribution of hair and other major indications of pituitary abnormalities. Three patients had evidences of acromegaly, amenorrhea was present in 5, and in 1 case there were changes in water metabolism and moderate obesity. We cannot report with certainty on minor endocrine changes

which might have been suggestive clinically.

The roentgenographic changes were readily observed on routine lateral stereoroentgenograms, but the extent of the destruction was much better delineated by means of midline laminagrams. In some patients it was not possible to arrive at a definite diagnosis on the basis of the skull film changes, and no correlation could be established between the clinical symptoms and the bone damage except for the presence of symptoms referable to the third, fourth and sixth cranial nerves in patients with extensive destruction.

Of the 28 cases of pituitary adenoma selected for this report, 20 revealed almost complete absence of the dorsum sellae and the floor of the sella turcica. In 15 of these the anterior wall of the sella had also disappeared. The anterior clinoid processes were visible in 18 cases, and were somewhat decalcified in these. In 5 patients the ghosts of the posterior clinoids could be faintly seen displaced upwards and dorsally. Of particular interest were the 8 patients in whom a granular type of destruction of the sella and sphenoid was present. At first glance these were suspected of harboring metastatic tumors or possibly chordomas. The explanation for this atypical appearance is difficult to ascertain on the basis of the facts available to us. The material obtained at operation clearly revealed the pituitary adenomatous origin of the tumor, but bone specimens were not obtained. It would be of great interest if one could detect actual bony invasion by a pituitary adenoma on microscopic examination, and we propose to watch for this change.

The intrasellar craniopharyngiomas observed by us presented markedly enlarged sellas, usually with fairly well maintained walls. In 3 the concomitant calcifications indicated the nature of the lesion, but in the others there was a distinct possibility of diagnosing the condition as pituitary adenoma, especially in adults.

The patients with aneurysms of the internal carotid artery presented varying degrees of bone atrophy and sellar enlargement. At times this simulated pituitary adenoma, but in cases with calcification of the walls of the aneurysm diagnosis should be readily made. Pneumoencephalographic examination disclosed a mass protruding into the cisterna interpeduncularis in 4 cases, which in 3 cases apparently supported the incorrect diagnosis of pituitary adenoma. Cerebral angiography is a far better diagnostic medium if such aneurysms are suspected.

The most advanced destruction observed by us occurred with lymphoepithelioma, sarcoma of the sphenoid, and metastatic tumors. The cases of metastatic tumor presented a considerable variation in destruction, varying from an erosion about 1.5 cm. in diameter to almost complete disruption of the sphenoid bone. Of interest is the fact that the dorsum sellae and floor of the sella may remain relatively intact with metastatic lesions, as well as with some tumors invading the sphenoid bone from its inferior aspect. Chordomas with intact dorsum sellae have been mentioned.

The atrophy of the sella turcica associated with hemispheral tumors in the cases chosen for comparison were advanced to the point of disappearance in some cases. Granular destruction was not observed in these or in the other 10 cases with posterior fossa or aqueduct block lesions. Other indications such as pineal shift or changes in the vault of the skull often indicated the extrasellar location of the primary tumor. Taken in conjunction with clinical evidences available there was little difficulty in establishing the nature of the sellar changes with brain tumors.

Pneumoencephalographic examination was of great importance in differential diagnosis, immediately providing evidence pointing towards hemispheral tumors or third ventricle changes. Demonstration of soft tissue masses protruding upwards from the sella turcica is significant, and at times such a mass extending into the foramen of Monro could be seen with pituitary tumors and craniopharyngiomas.

The relatively slight evidence of endocrine changes, even in cases with large pituitary adenomas, suggests that perhaps the destruction of the sella permits decompression of the tumor, which may permit the remaining glandular tissue to function. Consequently, a destroyed sella turcica with destruction of the sphenoid bone may indicate a pituitary adenoma in the absence of clinical endocrine changes. A trial with roentgen therapy may be helpful. Amelioration of ocular symptoms with little or no change in the bony configuration of the sphenoid may favor a pituitary adenoma, while return of osseous density may indicate a neoplastic infiltration. In many cases, however, final diagnosis may require histopathologic examination of tissue removed at operation or, when accessible, by nasopharyngeal biopsy.

SUMMARY

The causes of advanced atrophy and destruction of the sella turcica and sphenoid and their roentgenologic differentiation are discussed. The symptoms present with this condition are fairly constant and are chiefly referable to the visual apparatus. Manifestations of disturbed endocrine function may be minimal or absent.

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COR PULMONALE RESULTING FROM PULMONARY ARTERIOLOSCLEROSIS*

REPORT OF A CASE

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COR PULMONALE, according to the definition of Rigler and Hallock,[11] consists in enlargement of the right side of the heart with or without failure, initiated by increased resistance to blood flow within the lesser (pulmonary) circulation as a result of pulmonary disease. Numerous causes of cor pulmonale have been described: pulmonary fibrosis, silicosis, tuberculosis, emphysema, chest deformity accompanied by fairly marked degrees of scoliosis of the thoracic spine,[10] thrombosis of the pulmonary arteries with partial recanalization,[6] obstruction to the pulmonary circulation by metastatic carcinoma, either by direct involvement of the lumina of the arterioles or by thrombosis in arterioles adjacent to tumor-laden lymphatics,[3] as well as primary pulmonary arteriolosclerosis.

In 1941, Brill and Krygier[4] reviewed 20 cases of primary pulmonary arteriolosclerosis selected from the literature. Their requirements for the inclusion of a case under this diagnosis were: (1) significant hypertrophy of the right ventricle but not of the left; (2) absence of all factors commonly believed to cause secondary pulmonary vascular sclerosis, pulmonary hypertension, or isolated strain on the right side of the heart. The etiology of this disorder has not been determined but the hypothesis has been offered that the primary cause is a pulmonary hypertension of unknown origin, and that the changes in the pulmonary vessels are merely secondary to the hypertension. In their cases, both sexes were divided evenly; ages were variable; and all cases showed roentgen evidence of enlargement, dilatation, or prominence of the pulmonary artery or conus. Many showed right axis deviation on the electrocardiogram. Dyspnea and cyanosis were present in 14 cases. They believed that sudden death in some cases might be due to acute coronary insufficiency arising from the greatly diminished volume of blood delivered to the left ventricle through the obstructed pulmonary circulation.

REPORT OF A CASE

A nurse, aged thirty-four, was admitted to the hospital on November 24, 1943, because of edema of the legs of five days' duration. Previous history included nothing to suggest rheumatic fever. Five months previously she had developed paralysis of the left ninth nerve and left vocal cord for which no cause was determined. This had improved. She had always become out of breath more easily than the average person but she had been able to play tennis until a year before admission, at which time she noted dyspnea on climbing one flight of stairs. Six months before admission a loud pulmonic second sound and a systolic murmur on the left sternal border were noted. An electrocardiogram at that time showed right axis deviation. The patient complained of increasing dyspnea on exertion but denied orthopnea.

On physical examination after admission in November the blood pressure was 120/85; pulse was 90 and regular. Pitting edema of the legs up to the knees was found. The fundi were normal. The neck veins were distended but the liver was not felt and no evidence of free fluid in the chest or abdomen could be demonstrated. The lungs were clear. A loud systolic murmur was heard all over the precordium, loudest at the third left interspace. The murmur was not considered to be as loud or as rough as it should be if caused by a patent ductus arteriosus of sufficient size to play a significant part in causing decompensation. P2 was much greater

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than A2. *Laboratory findings:* The Kline test was negative (August, 1943). The blood examination showed hemoglobin (Sahli) 15.1 gm., red blood cell count 5,600,000. Venous pressure was 220 mm. of water (normal up to 100); vital capacity was 1,800 cc. The electrocardiogram showed right axis deviation, PR 0.18 second, T1 upright, low, T2 upright, T3 inverted, T4F diphasic, S1 deep, S2 small, S4F deep, R2 notched, Q3 deep. Blood chemistry showed non-protein nitrogen 27 mg., albumin 4.3 mg., globulin 1.4 mg.

Routine films of the chest six years before admission showed a normal heart shadow and clear lung fields (Fig. 1). On April 16, 1943 (seven months before admission) (Fig. 2), a prominence along the left border of the median shadow in the region of the pulmonary artery without enlargement of the heart was described. Roentgenoscopy of the heart a month later showed no evidence of enlargement of the left auricle; relatively slight pulsation could be seen in the right hilar shadow and downward along the branches of the pulmonary artery toward the diaphragm. On August 11, 1943, three months before admission (Fig. 3), still more enlargement of the pulmonary artery with persistently clear lung fields was found, with no evidence of enlargement of the heart.

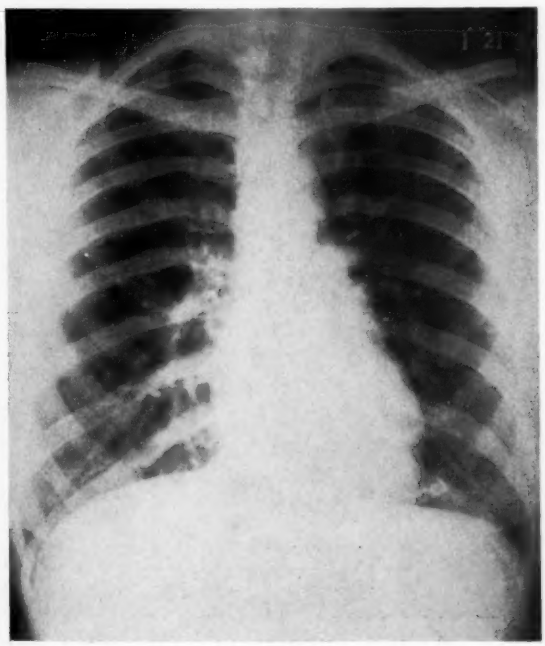

Fig. 1. Routine roentgenogram of the chest January 21, 1937.

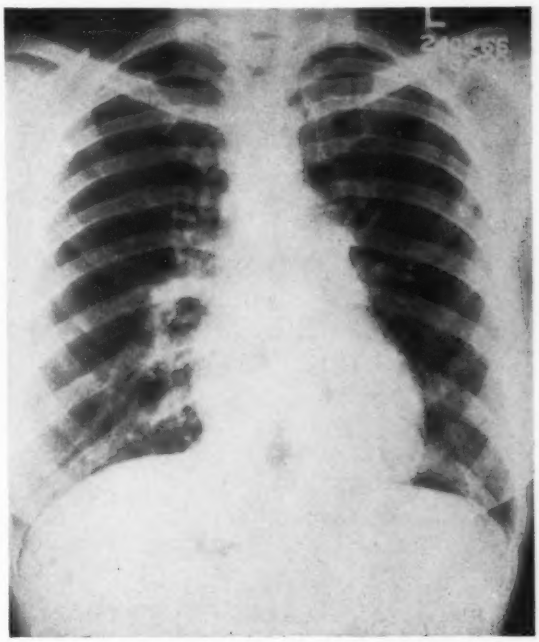

Fig. 2. Chest roentgenogram, April 16, 1943. Shows prominence in the region of the pulmonary artery.

At the time of admission (November 24, 1943), a film of the heart taken at 2 meters' distance (Fig. 4) showed that the transverse diameter of the heart shadow had increased 2.8 cm. since the examination seven months previously. The supracardiac shadow had enlarged 1.5 cm. The pulmonary artery on the left was more prominent than before but the hilar shadows were not particularly exaggerated. A small amount of fluid was found in the right costophrenic angle, but the lungs were clear. During this period repeated physical examinations revealed a progressively louder, sharper pulmonic second sound.

The patient was digitalized, and given ammonium chloride and mercupurin but a good diuresis did not occur. She was seen by a cardiologist who stated that the "picture is that of interauricular septal defect, with a large pulmonary conus and pressure on the recurrent laryngeal nerve." On her seventh hospital day she became cyanotic and more dyspneic. The blood pressure was too low to register. Respirations became more labored in spite of oxygen, and she died the following morning.

Postmortem Examination. Gross: There was no pitting edema of the extremities. The fingers and toes were not clubbed. About 200 cc. of

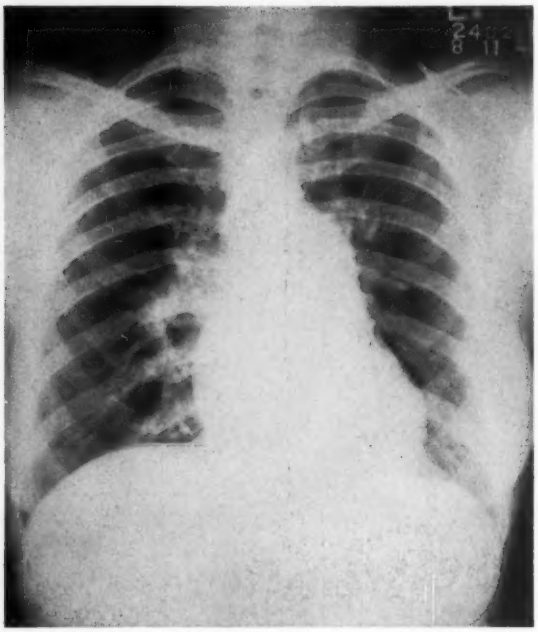

FIG. 3. Chest roentgenogram, August 11, 1943. Shows increase in prominence of the pulmonary artery, and in the vascular shadows in the right hilar area.

free fluid in the peritoneal cavity, about 300 cc. of blood-tinged fluid in each pleural cavity, and about 100 cc. of yellow fluid in the pericardium were found. The superior vena cava and its tributaries were unusually distended; the pulmonary artery was exceptionally large and there appeared to be some compression of the main pulmonary veins between the arterial trunks and the vertebrae. The heart weighed 380 grams and appeared very slightly enlarged for the size of the body. The right ventricle and to some extent the right auricle were considerably larger than the left side of the heart. The foramen ovale was completely closed. No thrombi were present. The right ventricle was considerably dilated; the wall measured 0.6–0.8 mm. in thickness (normal 0.4 mm). The pulmonary artery before its bifurcation measured 7.5 cm. in circumference, in comparison with a 5 cm. circumference of the aorta at the same level. The pulmonary conus was especially dilated and the pulmonary ring was wide. The intima of the pulmonary artery and its main branches was thickened by smooth gray and pinkish-gray plaques. The media was of normal thickness and the adventitia showed no change. There was no obstruction either by narrowing or thrombus at any point between the heart and the lungs. The ductus arteriosus was completely closed and there was no septal defect. The valves appeared normal. The aorta was somewhat small for an individual of this age; the intima showed only a few small yellow plaques. No evidence of pulmonary edema was found. The pulmonary arteries appeared stiff and projected above the retracted lung. The liver, spleen, pancreas and intestine showed congestion. No other abnormalities were found. The brain and cord were not removed.

Microscopic Examination. The right ventricle showed hypertrophy of the muscle fibers. The large and small coronary arteries were of normal thickness but a few of the medium-sized arteries showed moderate hypertrophy of the muscle coat without intimal sclerosis. Sections of the lung showed intense congestion of the alveolar walls. Many of the small and medium-sized pulmonary arteries showed a pronounced hypertrophy of the media without intimal sclerosis. There was no inflammation either within or about these vessels nor was any portion of the wall necrotic. The larger arteries had a moderate degree of intimal thickening due to an increased amount of loose cellular collagenous tissue. The veins and lymphatics appeared normal. Elastic

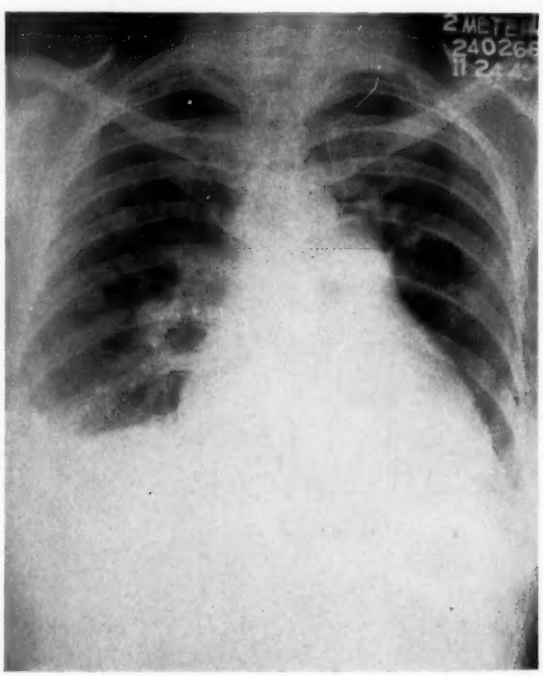

FIG. 4. Roentgenogram of the heart taken at 2 meter distance, November 24, 1943. Shows increase in size of the heart and right hydrothorax.

tissue stain demonstrated well the marked hypertrophy of the muscle coat of the small arteries (Fig. 5). There was no duplication of the elastic membrane and no intimal sclerosis in the majority of these vessels. However, occasionally there was intimal thickening rather than muscle hypertrophy. In other organs the small arteries were normal.

The final note states, "This is a case which arouses much interest and raises some at present unanswerable questions. The symptoms were those of right-sided cardiac failure without valvular disease and, as the autopsy proves, without intrinsic cardiac anomaly or muscle disease. Attention was therefore directed to the pulmonary vessels as the most likely cause for the extreme hypertrophy of the right ventricle. The changes, however, seem hardly commensurate and consist almost entirely of muscle hypertrophy, with definite anatomical narrowing of the lumina of the pulmonary vessels. One must have recourse then to some hypothetical functional spasm or hypertension, and histologic study affords not the slightest clue as to its cause." The anatomical diagnoses in this case were as follows:

Hypertrophy of pulmonary arterioles; sclerosis of pulmonary arteries and arterioles; chronic passive congestion of liver, spleen and pancreas; hydrothorax; hydropericardium; ascites.

COMMENT

This case presents a number of features which are of special interest to the radiologist as well as to the pathologist. The initial film made on January 21, 1937, at the age of twenty-eight, demonstrated no obvious evidence of disease of the heart or lungs. At that time, the patient was asymptomatic. On April 16, 1943, at the time this patient made her first complaint of dyspnea, an obvious prominence of the left border of the heart in the region of the pulmonary artery was apparent. Also at this time, the transverse diameter of the heart was wider than on the examination of January 21, 1937. There is nothing in this patient's clinical history or laboratory findings to support a diagnosis of rheumatic carditis. Roentgenoscopic examination showed no enlargement of the left auricle.

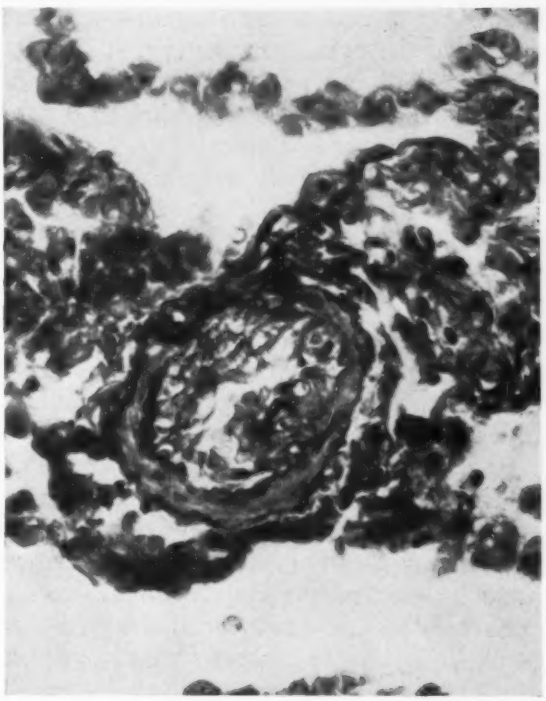

Fig. 5. Elastic tissue stain of pulmonary arterioles showing hypertrophy of walls.

The enlargement of the pulmonary artery, as demonstrated on the film of April 16, suggests hypertension in the pulmonary vascular bed with the development of a cor pulmonale. The most common causes of such hypertension in the pulmonary vascular bed are failure of the left ventricle[13] and pulmonary emphysema. Nothing in the appearance of the heart shadow or of the lung field supports either possibility. The fact that the smaller vascular shadows are not prominent in the lung fields on either side, together with the evidence of enlargement of the pulmonary artery above the conus, indicates the possibility that the increasing back pressure upon the right side of the heart originates in the lungs themselves. This feature has been mentioned by Fishberg[9] in pulmonary endarteritis. The increasingly loud pulmonic second sound gave further support to the diagnosis of hypertension in the pulmonary vascular bed. The successive films on August 11, 1943, and on November 24, 1943, disclosed the progressive enlarge-

ment of the cardiac shadow and increase in size of the pulmonary artery. It is noteworthy that, even on the examination of November 24, 1943, shortly before death, when there was certainly some associated left ventricular failure, the peripheral portions of the lung fields were remarkably clear.

In the differential diagnosis, one must review all possible causes of right-sided hypertrophy and enlargement of the pulmonary artery. In mitral stenosis, enlargement of the left auricle usually precedes significant enlargement of the pulmonary artery as demonstrated roentgenologically.[8] In the presence of a patent ductus arteriosus, the characteristic murmur should be of help. It is generally held that, in the absence of such a machinery murmur, the diagnosis cannot be made with certainty.[12] In approximately 80 per cent of cases of patent ductus, there is an associated enlargement of the heart in the region of the left ventricle.[7] The absence of evidence of left ventricular failure and pulmonary emphysema, which are the common causes of cor pulmonale, has already been mentioned. Congenital defects, such as interauricular septal defect may be associated with marked enlargement of the heart and enlargement of pulmonary arteries.[1] In the presence of a congenital lesion such as this, it would seem unlikely that the heart and lungs would appear normal as they did on the initial survey film made in 1937 when the patient was twenty-eight years old.

Several conditions have been described where obstruction of the smaller arterioles within the lungs has given rise to the development of a cor pulmonale. Brill and Robertson[3] described several cases of neoplastic infiltration of the smaller peribronchial lymphatics with secondary obstruction of the peripheral vessels in the lungs. Yater and Hansmann[14] first described the development of cor pulmonale in the presence of thrombotic occlusion of the smaller peripheral vessels of the lung in the presence of sickle cell anemia. Thromboses in these smaller arterioles of the lungs of undetermined etiology have also been described.[5] Fishberg[9] mentions *Schistosoma* infestation of the pulmonary vascular bed resulting in blockage of the minute pulmonary vessels, causing right ventricular strain and failure.

In most of the cases of primary pulmonary arteriolosclerosis reviewed by Brill and Krygier,[4] microscopic findings are described as showing intimal thickening of the smaller vessels rather than hypertrophy of the muscle coat found in this case. In one of Brenner's cases[2] (a boy aged eleven), quoted by Brill and Krygier, hypertrophy of the media as well as endothelial proliferation was noted. Brenner comments that several different lesions have been reported under the name of primary pulmonary vascular sclerosis. In all cases, some of the vessels escaped, just as they did in this case.

SUMMARY

A case of primary pulmonary arteriolosclerosis with hypertrophy of the muscle of the pulmonary arteries in a thirty-four year old female is reported. The outstanding manifestation, demonstrable by roentgen examination, was the development of dilatation of the pulmonary artery without evidence of disease of the lungs.

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PULMONARY METASTATIC SARCOMA WITH ASSOCIATED PNEUMOTHORAX*

REPORT OF TWO CASES

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THE purpose of this communication is to present 2 case reports of osteogenic sarcoma which developed pulmonary metastases with an associated unilateral pneumothorax.

In our search through the literature, we have found 5 previously reported cases of a similar nature.[1,3]

CASE REPORTS

CASE I. The patient was a white boy, aged eleven, first seen in the Robert Winship Memorial Clinic on June 6, 1949, with the chief complaint of "a knot on my right leg." Five weeks previously, the patient stated that he had noticed a little swelling of the right leg near the knee. Three weeks later the swelling rapidly increased in size and an aching pain became more severe. He was, however, able to run and play without much difficulty. Roentgenograms at that time revealed a tumor of the right tibia, probably osteogenic sarcoma (Fig. 1).

FIG. 1. Case 1. An osteogenic sarcoma is present in the superior portion of the shaft of the right tibia.

The past history revealed that the patient had had asthma "all of his life," for which condition he had been treated by his family physician.

On physical examination the boy appeared chronically ill. Loud asthmatic squeaks and groans were noted throughout both lung fields. A chest roentgenogram showed no evidence of metastatic disease. Abdominal examination revealed no unusual findings, and the external genitalia were normal. A rather firm, moderately tender mass was palpated along the proximal third of the right tibia. The skin temperature in this area was increased. There was no limitation of motion of the right knee. There were no masses or nodes palpable in either inguinal region.

A right mid-thigh amputation was performed at Emory University Hospital on June 11, 1949. The pathologic diagnosis was osteogenic sarcoma of the right tibia.

The patient was sent home under the care of his family physician, and had no complaints except for asthma, which was no worse than on previous occasions. On January 31, 1950, the patient returned for a follow-up examination and consultation regarding a prosthesis. A chest roentgenogram at that time demonstrated generalized nodules throughout both lung fields and a pneumothorax on the right (Fig. 2).

CASE II. The patient was a white male, aged twenty, admitted to the Piedmont Hospital, Atlanta, Georgia, with the chief complaint of an aching pain in his right shoulder for one month. The pain originated in the deltoid region and radiated down the anterior

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aspect of the forearm. Roentgenograms revealed a destructive process involving the proximal right humerus, and a diagnosis of primary bone malignancy was made (Fig. 3).

The patient appeared to be well developed and well nourished, and in no acute distress. On physical examination, no abnormalities of the lungs, heart, or abdomen were detected. A roentgenogram of the chest demonstrated no evidence of metastatic disease. There was tenderness to palpation in the right shoulder region. Active extension of the right arm was impossible and abduction was painful.

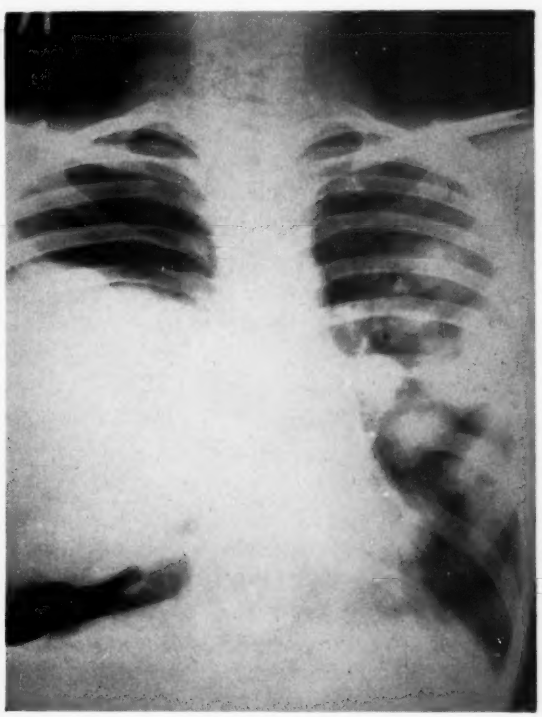

Fig. 2. Case 1. Large metastatic nodules are present bilaterally. A pneumothorax is present on the right. The left lung is normally expanded.

The patient's past history and family history were non-contributory.

On November 10, 1948, a radical amputation of the right shoulder and arm was performed. The pathologic diagnosis was spindle cell sarcoma, Grade 3, probably osteogenic.

On the third postoperative day, the patient developed diarrhea and motile forms of *Endamoeba histolytica* were found in the stools. Emetine, carbarsone, and diodoquin were administered. At the same time, the patient was started on Coley's toxin for the proved malignancy. He developed chills and fever following the Coley toxin therapy and electrocardiographic findings of myocardial involvement which were attributed to the emetine administration.

Fig. 3. Case 11. The primary bone malignancy is present in the proximal right humerus. Pathologic diagnosis was, "spindle-cell sarcoma, Grade 3, probably osteogenic sarcoma."

A roentgenogram of the chest on November 29, 1948, three weeks after operation, showed a small pneumothorax on the right and no de-

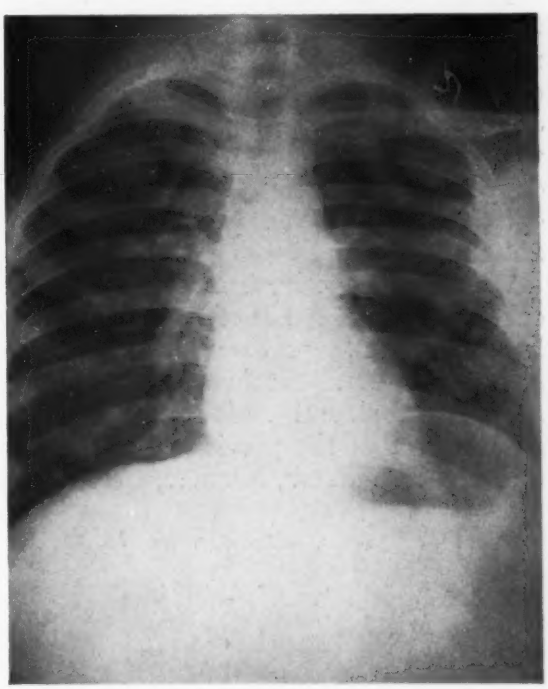

Fig. 4. Case 11. A chest film made approximately ten weeks following the operation. Numerous small metastatic nodules are present in each lung. A partial pneumothorax is present on the right.

monstrable pulmonary metastases. A follow-up roentgenogram of the chest on January 24, 1949, again demonstrated a right pneumothorax and the development of innumerable small nodulations throughout both lung fields (Fig. 4). The patient died approximately two months later and no postmortem examination was obtained.

DISCUSSION

In Case I, the lungs were roentgenographically normal at the time of operation, but eight months later there were seen massive nodules bilaterally and a partial pneumothorax on the right side (Fig. 2).

In Case II, the initial chest roentgenogram immediately prior to operation did not disclose pulmonary metastases or pneumothorax. The second film made three weeks later showed a slight collapse of the right lung, but no obvious metastases. The third film, two months later, showed the presence of bilateral metastases and a slightly greater degree of pneumothorax on the right.

In this latter case, it might be argued that the pneumothorax seen on the film made three weeks after operation was caused by the operative procedure; however, in our opinion, it was secondary to metastases already present but not visible on the roentgenogram. According to the operative report, the pleural space was not entered.

The possible mechanisms producing lung collapse in the presence of metastases have been discussed by previous investigators.[1,3] A bronchopleural fistula developing in a necrotic subpleural nodule was demonstrated in 2 of the previously reported 5 cases. These authors, however, were reluctant to accept this as the cause in every case, and suggested that the route may be that described by Macklin and Macklin,[2] wherein air from ruptured alveoli dissects through the perivascular connective tissue spaces toward the mediastinum or the visceral pleura and, thence, into the pleural space. We are unable to explain the basic etiology in our 2 cases since neither of these cases came to postmortem examination. In our Case I, the long-standing asthma may have been an important predisposing factor in the production of the pneumothorax.

SUMMARY

Two additional cases of sarcoma, primary in bone, and with pulmonary metastases and associated spontaneous pneumothorax have been presented.

The authors wish to express their appreciation to Dr. George Hrdlicka for the loan of the roentgenograms of the patient presented in Case II.

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Vol. 66, No. 6

PATHOLOGY AND CLASSIFICATION OF TUMORS OF THE SOFT TISSUES*

By ARTHUR PURDY STOUT, M.D.

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WE ARE living today in a medical era characterized by publicity, specialization, and the wonders of chemistry. The origin and development of that branch of medicine which deals with tumors and is sometimes called oncology is one of its resultant phenomena. The common malignant tumors are advertised to the public and their recognition and treatment, morbidity and mortality incidence and etiology, experimental study and every other phase of them now receive intensive, ceaseless attention. But the uncommon tumors, unless they happen to be hormonally active or to involve a popular organ like the ovary, are still relatively unknown, poorly understood and as a natural consequence generally badly treated. The soft tissues of the body, if one excepts the skin, are not often spoken about in medical circles and are certainly neglected in journals and textbooks. Most of the malignant tumors of the soft tissues are called sarcomas. The lymphosarcomas arising in lymph nodes and the other lymphatic stations of the body are relatively familiar, especially since the introduction of nitrogen mustard and other chemotherapeutic agents. Likewise, the bone sarcomas are not unknown because of the attention they have received from such an array of keen enthusiasts as Bloodgood, Codman, Ewing, the Coleys, Jaffe, Phemister, and many others, and because they contain a very popular tissue, the bone marrow. But who has published a monograph on the soft tissues or its tumors? So far as I am aware, no one. Yet I venture to say that the primary malignant tumors of the soft tissues are as frequently encountered in a general hospital service as are the primary malignant tumors of bone. If one adds to them the benign tumors and tumor-like processes, the soft tissues of mesodermal origin stand almost coequal with the epithelial elements of the skin.

If I am to talk of the soft tissues, I must define the term, for it could mean all the tissues of the body except the bones. Actually it is customary to exclude all organs, the lymph nodes, all the epithelial elements of the skin and all mucous membranes. This leaves for consideration most of the tissues covering the exterior of the body and internally those which fill in its crevices, notably the retroperitoneum, mediastinum and orbit. In Table 1 are shown the names of the various benign tumors and tumor-like processes and the malignant sarcomas which may arise primarily in the soft tissues. There are 66 names included, 44 of them benign and 22 malignant. Each one of these processes is an entity with characteristic ways of growth and biological potentialities peculiar to itself. Some of them are very common but several are so rare that very little indeed is known about them. A number of them are chiefly notorious because of some dominant feature. For example, there are the pain producers; the glomus tumor, the cutaneous and subcutaneous leiomyoma and multiple painful lipomatosis. Both benign and malignant fatty tumors sometimes grow to a great size. So far as I am aware, the largest and heaviest tumor ever recorded was a lipoma reputed to weigh 275 pounds. Lipomas have other growth peculiarities. Not only may they be multiple and sometimes painful, but occasionally multiple lipomatosis may be symmetrical producing a weird distortion of the anatomical configuration. Another strange characteristic of the lipomas noted by Gideon Wells is that although their fat is chemically indistinguishable from normal body fat, it is unavailable to the body in

* From the Laboratory of Surgical Pathology of Columbia University, and the Presbyterian Hospital, New York, N. Y. Presented at the Thirty-second Annual Meeting, American Radium Society, New York, N. Y., May 25–26, 1950.

TABLE I

TUMORS OF THE SOFT TISSUE

Benign Tumors and Tumor-like Proliferations		Malignant Tumors
Fibromatoses		
Fibroma	Fibromatosis colli (cong. wry neck)	Fibrosarcoma
Desmoid		Myxoma
Keloid		Liposarcoma
Palmar and plantar fibromatosis	Progressive myositis fibrosa	Leiomyosarcoma
Penile fibromatosis (Peyronie's disease)	Irradiation fibromatosis	Rhabdomyosarcoma
Myxomatoses		Malignant granular cell myoblastoma
Ganglion	Localized myxedema	Angiosarcoma
Xanthomatoses		Malig. hemangioendothelioma
Xanthoma (histiocytoma)	Fibrous xanthoma (sclerosing hemangioma)	Malig. hemangiopericytoma
Multiple xanthomatosis	Xanthogranuloma	Kaposi's disease
Xanthoma diabeticorum	Giant cell tumor	Malig. lymphangiosarcoma
Xanthelasma		Malignant bone and cartilage tumors
Lipomatoses		Osteogenic sarcoma
Lipoma	Lipoma arborescens	Chondrosarcoma
Multiple lipomas	Hibernoma	Synovial sarcoma
Multiple symmetrical lipomatosis	Fat necrosis	Malignant mesothelioma
Benign Muscle Tumors		Malig. mesenchymoma
Leiomyoma	Granular cell myoblastoma	Melanosarcoma?
Rhabdomyoma		Malig. lymphoid and reticulo-endothelial tumors
Angiomatoses		Lymphosarcoma
Hemangioma (capillary, cavernous, venous, granuloma pyogenicum)	Glomus tumor	Giant follicle type
	Cirsoid aneurysm	Lymphocytic type
Benign hemangioendothelioma	Venous racemose aneurysm	Reticulum cell type
Benign hemangiopericytoma	Diffuse angiomatosis (cong. arteriovenous fistula)	Reticulum cell sarcoma
	Lymphangioma (cystic hygroma)	Mycosis fungoides
Osteomatoses		Plasma cell tumor (Hodgkin's disease?)
Osteoma	Myositis ossificans (solitary and progressive)	
Chondroma		
Benign synovioma		
Benign mesothelioma		
Mixed tumor		
Benign mesenchymoma		
Blue nevus?		

starvation so that all normal body fat can be consumed while the lipomas increase in size. There are many tumor-like fibromatoses which produce bizarre deformities because of the tendency of the new-formed collagen in them to contract. There are congenital wry neck, the proliferative form of Dupuytren's contracture, Peyronie's disease or penile fibromatosis, keloids, desmoid tumors and progressive fibrous myositis, to name only a few of them. This list could be augmented with the familiar bizarre vascular growths and many others, but enough has been said to

TABLE II

PRIMARY MALIGNANT TUMORS OF SOFT PARTS

Surgical Pathology Laboratory, Columbia University, July, 1906–January, 1949

Type of Tissue	Benign	Malignant	Cases	Malignant from Benign	Recurrence	Metastasis	Died
Fibrous tissue	Fibroma Fibromatoses	Fibrosarcoma	222	Occasionally	51.7%	6.9%	17.2%
Adipose tissue	Lipoma	Liposarcoma	115	1 case	66.0	34.0	37.0
Smooth muscle	Leiomyoma	Leiomyosarcoma	25	?	90.0	30.0	80.0
Striated muscle	Rhabdomyoma (?)	Rhabdomyosarcoma	38	?	85.0	40.0	65.0
	Granular cell myoblastoma	Granular cell myoblastoma	5	?	yes	yes	yes
Blood and lymphatic vessels	Hemangioma (all types)	Angiosarcoma, incl.:	81	Never seen	60.0	36.0	36.0
		hemangioendothelioma 18					
		hemangiopericytoma 41					
		Kaposi's disease 22					
	Lymphangioma						
Synovial mesothelium	Synovialoma (?)	Synovial sarcoma	13	?	yes	yes	yes
Lymphatic and reticuloendotheal tissues	Xanthoma	Lymphosarcoma (incl. mycosis fungoides)	23	Never seen	yes	yes	yes
	Xanthogranuloma						
	Giant cell tumor	Reticulum cell sarcoma	24	Never seen	yes	yes	yes
		Plasmocytoma	1	Never seen	yes	yes	yes
Mesodermal melanoblasts	Blue nevus	Melanosarcoma	1(?)	?	no	no	no
Undifferentiated mesenchyme	Mesenchymoma	Myxoma	50	?	56.0	0	6.0
		Mixed mesodermal tumor	19	Never seen	40.0	60.0	60.0
Heterotopic bone and cartilage	Myositis ossificans	Osteogenic sarcoma	1	Never seen	yes	yes	yes
	Osteoma	Chondrosarcoma	1	Never seen	yes	yes	yes
	Chondroma						
Nerve sheath	Schwannoma	Schwannoma	20	Yes (from neurofibroma)	yes	yes	yes
	Neurofibroma	Neuroepithelioma (all types)	7	Yes (from neurofibroma)	yes	yes	yes
			646				

indicate the diversity of the peculiar manifestations of the benign mesodermal soft tissue tumors and proliferations.

While a few of these benign growths can be diagnosed with some degree of accuracy from their clinical characteristics many of them cannot. Of the 22 varieties of sarcomas, none can be diagnosed with complete assurance from their clinical aspects while they are still in a curable state. It is only by a study of the histopathology through a microscope that an accurate diagnosis can be made, and it is only by knowledge of the expected behavior of each one of the different tumor types that the proper form of therapy can be instituted. Before enlarging upon this subject it will be wise to make a brief survey of the different forms of sarcoma.

Table II shows a listing of the various types of malignant tumors with the numbers of cases of each recorded in the surgical pathology laboratory of Columbia University. It indicates that some varieties are very rarely seen and that about three-fourths are included among the fibrosarcomas, liposarcomas, malignant vascular tumors, and myxomas, while the rest are represented by very small numbers indeed. This emphasizes the extreme difficulty of learning about the behavior of the rarer tumors for it has taken forty-three years to assemble these few. It may well be asked why is it necessary to recognize and name such a great variety when a very small number of names suffices for the stomach, breast, uterus, intestine, skin, and in fact almost all of the common cancers. The answer to this lies in the fact that when the term soft tissues is used, it concerns not just one organ but a composite of many tissues: connective tissue, fat, blood, and

TABLE III*

FIBROSARCOMA

Laboratory of Surgical Pathology, Columbia University 1907–1946

Region	Cases	Followed	Recurrence	Metastasis	Died Tumor	Alive after onset (years)			
						0–4	5–9	10+	Total
Skin	29	18	6	0	0	6	4	8	18
Scar	36	24	13	2	4	9	4	7	20
Subcutaneous	58	40	26	1	6	19	8	7	34
Muscle, tendon, tendon sheath	37	25	13	3	4	10	4	7	21
Desmoid (abd. muscles)	12	7	0	0	0	2	3	2	7
Periosteum	13	11	9	1	3	4	2	2	8
Upper respiratory	7	6	5	0	2	0	4	0	4
Oral cavity and salivary glands	5	2	1	1	2	0	0	0	0
Lung, pleura, bronchus	4	3	0	1	3	0	0	0	0
Mesentery	6	4	1	0	0	2	2	0	4
Retroperitoneum	2	1	1	0	0	1	0	0	1
Gastrointestinal	2	1	0	0	0	1	0	0	1
Female mammary gland	4	1	0	0	0	0	0	1	1
Penis and scrotum	2	1	0	0	0	0	0	1	1
Kidney	1	1	0	1	1	0	0	0	0
TOTAL	218	145	75 (51.7%)	10 (6.9%)	25 (17.2%)	54	31	35	120
Male 100 Female 118									

* From Stout, A. P., Fibrosarcoma. *Cancer*, 1948, *1*, 30–63 (Table 1).

lymphatic vessels, reticuloendothelium, smooth and striated muscle, fascia, and synovial structures, to name only the more common. Moreover, the mesodermal derivatives seem to have some degree of metaplastic versatility so that one variety of tumor may assume some of the characteristics of another or be composed of an admixture of several kinds of tissues.

One should realize that even a large experience does not qualify one to make an accurate clinical diagnosis of the exact nature of most of the sarcomas. Only in the case of Kaposi's disease could one make such a clinical diagnosis with a reasonable degree of assurance and this is a malignant process for which there exists no known curative therapy. Of the remainder, some like dermatofibrosarcoma protuberans, myxoma and melanosarcoma are only locally malignant and do not metastasize; others like synovial sarcoma, malignant hemangioendothelioma and rhabdomyosarcoma are almost always fatal, and the rest, including the more malignant types of fibrosarcoma, are malignant but may be cured if treated properly and at an early stage before metastasis has occurred. When metastasis occurs it is most common for it to take place through the blood stream. In a few instances, metastases may pass through the lymphatics and lodge in the regional lymph nodes, but this does not occur with sufficient frequency, in my opinion, to warrant the routine resection of these nodes if there is no clinical evidence of their involvement. The best hope of cure lies in the successful removal of the primary growth before metastasis has taken place.

It will not be possible to take up each variety of tumor in detail but it may be of value to give some details of the commonest of the malignant tumors in this group, namely fibrosarcoma. If one reads some of the published analyses of fibrosarcoma one gains the impression that it is an exceedingly malignant and fatal neoplasm. Actu-

TABLE IV*

DIFFERENTIATION

	Cases	Followed	Recurrence	Metastasis	Died tumor	Alive after onset (years)			Total
						0–4	5–9	10+	
Poor differentiation	51	41	31 (75.6%)	10 (24.4%)	21 (50.1%)	9	5	6	20 (49.9%)
Good differentiation	167	104	44 (42.3%)	0	4† (3.8%)	45	26	29	100 (96.2%)
Total	218	145	75 (51.7%)	10 (6.9%)	25 (17.2%)	54	31	35	120 (82.8%)

* From Stout, A. P., Fibrosarcoma. *Cancer*, 1948, *1*, 30–63 (Table III).
† Primary sites in pharynx, periosteum of mandible, pleura and abdominal wall. Death due to local extension.

ally this does not seem to be true. The reasons for the misconception are, first, that the less malignant fibrosarcomas were ignored, and second the inclusion of a variety of other sarcomas under this heading. This latter error has occurred because of the tendency of all kinds of mesodermal and even neurectodermal cells to assume a fibroblastic activity which may mask their real nature and lead to diagnostic error on the part of a pathologist. Table III shows a listing of 218 cases of fibrosarcoma, 145 of which were followed. Only 10 of these were known to have metastasized and only 25, or 17.2 per cent, were known to have died of tumor. These figures are all the more striking when it is seen that over half of the cases had a local recurrence, indicating that the primary treatment was inadequate. In this table it should be noted that fibrosarcomas which originate in the skin did not metastasize and no deaths from tumor were recorded but that recurrences were not uncommon. All the rest of the tumors except the desmoids of the abdominal musculature, which are not true sarcomas, were potential killers. Is there any sure way of recognizing the more malignant fibrosarcomas? Table IV shows that fibro-

TABLE V*

PRIMARY SARCOMAS OF THE SOFT PARTS

(July, 1906–June, 1946, inc.)

Tumor	Total	Followed	Recurrence	Metastasis	Died Tumor
Fibrosarcoma	184	120	66 (56)	9 (8)	15 (13)
Myxoma	40	18	10 (56)	0	1 (6)
Liposarcoma	73	35	23 (66)	12 (34)	13 (37)
Rhabdomyosarcoma	25	20	17 (85)	8 (40)	13 (65)
Malig. granular cell myoblastoma	3	2	2 (100)	2 (100)	2 (100)
Leiomyosarcoma	13	10	9 (90)	3 (30)	8 (80)
Hemangioendothelioma	12†	7	6 (86)	5 (71)	3 (43)
Hemangiopericytoma	25†	12	5 (42)	2 (17)	3 (25)
Kaposi's disease	15	6	4 (67)	2 (33)	3 (50)
Synovial sarcoma	9	7	6 (86)	6 (86)	6 (86)
Lymphosarcoma (primary)	17	10	5 (50)	4 (40)	5 (50)
Reticulum cell sarcoma	9	6	3 (50)	3 (50)	4 (67)
Plasmocytoma	0	—	—	—	—
Melanosarcoma	1	1	0	0	0
Mesenchymoma	6	5	2 (40)	3 (60)	3 (60)
Total	432	259	158 (61)	59 (22.8)	79 (30.5)

* From Stout, A. P., Sarcomas of soft parts. *J. Missouri M. A.*, 1947, *44*, 329–334 (Table 1).
† Excluding benign forms in infants. Figures in parentheses represent percentages of followed cases.

sarcomas can be divided into two groups according to the amount and thickness of the connective tissue fibers formed, the degree of resemblance of the tumor to proliferated scar tissue and the relative number of mitoses. If there are few fibers formed, a disorderly arrangement of cells and many mitoses, the tumor is poorly differentiated and the recorded death rate is high. But if differentiation is good, the fatalities are few and due solely to the eventual effects of unchecked infiltrative growth.

Enough has been said to indicate that with a recurrence rate of 61 per cent for the entire group of soft part sarcomas, as shown in Table v, their treatment has been extremely unsatisfactory. The reason for this is the fact that surgeons or others who undertake the treatment of these malignant tumors as a rule fail to realize that a common characteristic of almost all of them is insidious infiltrative growth so that one must expect that tumor cells may extend far outside of the palpable confines of the tumor. Consequently, an attempt to excise the tumor by shelling out or even excision just outside of its palpable limits generally cuts through tumor tissue at some point. Not only may this leave tumor cells behind at that point but instruments may carry tumor cells to any part of the wound, including all of the opened tissue spaces, and in the case of some tumors may facilitate metastasis. Quite possibly this accounts for some of the failures to cure by subsequent amputations and other more radical procedures. It would seem to me that this is not an intelligent way to undertake treatment. Since clinical diagnosis is usually unreliable and it would not be desirable to subject a patient to radical treatment for a benign tumor, the first indication is to find out the nature of the growth by biopsy. This should be carried out with great care, using the smallest possible incision, maintaining meticulous hemostasis and discarding the instruments used for biopsy before repairing the wound. If it is possible to make an accurate diagnosis by frozen section, the appropriate treatment may then be undertaken at once. In my experience it is generally better to wait for quick paraffin sections because diagnosis is so difficult. Then armed with knowledge one can proceed to the appropriate treatment which is in most cases by surgery. This can be summarized by saying that for all recurring tumors, if cure is the aim, the line of excision must pass at a distance of 3 or more centimeters outside of the palpable tumor limits at all points. This does not always mean amputation. In some regions, such as the mediastinum and retroperitoneum, it is impossible. There may be one exception to the biopsy rule. Occasionally in such areas as the buttock or thigh, radical excision may be carried out without biopsy for relatively small tumors. As a result of study of the behavior of the various malignant sarcomas, the most radical form of surgical removal is indicated for the poorly differentiated fibrosarcoma, rhabdomyosarcoma, synovial sarcoma, malignant hemangioendothelioma lymphangiosarcoma, malignant mesenchymoma, poorly differentiated liposarcoma, osteogenic sarcoma and chondrosarcoma, reticulum cell sarcoma, and leiomyosarcoma. Generally it is unnecessary to do amputations for myxoma, differentiated liposarcoma, melanosarcoma, or fibrosarcoma of the skin, since these tumors do not metastasize, but wide excisions should be carried out because of the frequency of recurrence. Neither amputation nor radical surgery of any kind should be used for Kaposi's disease because it cannot be cured and it is generally better to use radiotherapy for lymphosarcoma although, if apparently solitary and small, excision can be just as effective as radiotherapy. Since as yet it is not possible with certainty to recognize the gross or microscopic characteristics of the malignant forms of hemangiopericytoma and granular cell myoblastoma it is difficult to formulate a definite policy regarding their surgical

treatment. One must keep in mind the possibility that sometimes these tumors can metastasize and kill. The tumors which are somewhat radiosensitive are Kaposi's disease, reticulum cell sarcoma, lymphosarcoma, a small liposarcoma, and plasmocytoma, but the chances of effecting a cure are exceedingly remote, except for an occasional case of reticulum cell sarcoma and lymphosarcoma.

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BRUCELLA INFECTION OF BONES AND JOINTS*

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BRUCELLOSIS is a general infection caused by one of the sub-species of *Brucella melitensis*. The natural habitat of these organisms is in the domestic animals. This disease is characterized in the cow by repeated abortions, followed often by a carrier state through chronic infection of the udder, and excretion of the bacteria in the milk.

For man the principal contact sources are cattle, goats, sheep, and swine. Undulant fever in man and the epidemic infectious abortions in animals were unrelated until Evans, in 1918, called attention to the relationship existing between the organisms causing the two diseases. The causative organism was discovered in 1895 by Bang, and von Stribolt, MacNealy and Heri isolated the specific organisms from cattle in 1910. The first cases of undulant fever reported in man were reported by Craig in 1905. The diagnosis and treatment of this condition has, in the past, been indefinite and debatable. The condition has often been overlooked because of long-standing symptoms of aching, fatigue, and depression. Many patients have been branded as neurasthenics because of the indefinite symptomatology. The diagnosis and treatment of the disease is chiefly the concern of the internist and the general practitioner. However, a review of the literature will show that brucellosis demands the attention of the orthopedist almost as often as it does any other medical specialist.

An early symptom of special interest in this disease is low back pain. The orthopedist should always be on the lookout for this disease in his "hard to account for symptoms of the patient." The symptoms which usually bring the patient to the doctor are caused by the chronic stage of the disease. The term "chronic undulant fever" is rather misleading, particularly the word "fever" as, in the chronic state, there is often very little elevation of temperature. More confusion results from the various manifestations of the disease that make it resemble both tuberculosis and syphilis. Typhoid, paratyphoid, rheumatic fever, influenza, and some other diseases, must also receive careful consideration in the differential diagnosis. Brucellosis attacks the vertebrae more often than any other bones in the body. The most common location, in the vertebrae, is in the lumbar spine. It is most often dry, although abscess formations have occurred which necessitated incision and drainage.

Hardy reports 375 cases occurring in Iowa in which 32 per cent involved the joints. Simpson reports 175 cases in Ohio, 32 per cent involving joints. Steindler[5] refers to polyarthritic dissemination of the serious type and states that joint manifestations in undulant fever occur eight to twelve weeks after the acute onset of the disease, which helps to differentiate this disease from pyogenic arthritis or osteomyelitis. This joint is illustrated by the case which is presented below. Many cases of myotendonitis will be found, after careful study by the internist and orthopedist, to be caused by brucellosis. In these cases there is usually a very confusing history with symptoms of generalized weakness, headaches, eye aches, pain, tightness in the neck, and inability to concentrate. These indefinite symptoms cause many patients to be called neurasthenic and some of them have been to many doctors. The location of this myotendonitis is usually in the hips, gluteal muscles, or shoulders where it appears as a subacromial bursitis, either chronic or acute.

Much more research needs to be carried out before brucellosis can be properly evaluated. We must have more standardized

* Presented at the Ninth Harlow-Brooks Memorial Conference at Sage Memorial Hospital, Ganado, Arizona, Aug. 30–Sept. 1, 1948.

laboratory procedures, more clinical observation, and more study of its treatment. It is estimated that 30,000 to 40,000 new victims are added each year to the thousands already suffering from undulant fever in this country. Various treatments have been used such as the vaccine, supportive treatment, the sulfonamides, streptomycin, and penicillin, and some years ago intravenous antiseptics such as metaphen and mercurochrome were widely used.

It was recently stated that a streptomycin-sulfadiazine combination effected a cure in 9 cases. This was reported in *The Arizona Republic* in the article, "Your Health and Mine." This has not been confirmed by other authoritative medical information.

The following is a case of undulant fever involving the hip joint. I have found 7 similar cases reported. O'Donoghue[2] reports a case of septic arthritis of the right hip joint in a girl twelve years of age in which an operation was done because of the probable bulging of the joint capsule. The pus obtained contained *Brucella melitensis*. The end result in this case was ankylosis of the hip.

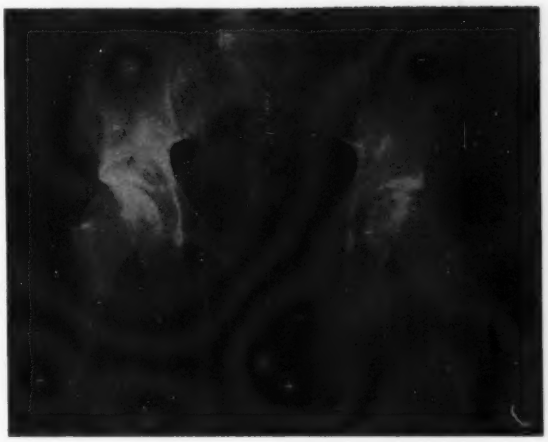

Fig. 1. Anteroposterior view of hip joint two days following injury.

REPORT OF CASE

G. R., male, aged thirty-seven, was admitted to the hospital on October 23, 1941. He had wrenched the left hip while moving heavy machinery on October 15, 1941. He hobbled along on this leg for two days until the pain became unbearable, then he spent a week in bed at home. During this time he lost 20 pounds in weight. A roentgenogram (Fig. 1) taken on admission to the hospital revealed a flexion deformity of the left hip and two minute chips from the left acetabulum. The leukocyte count was 14,000 per cu. mm. Traction was applied to

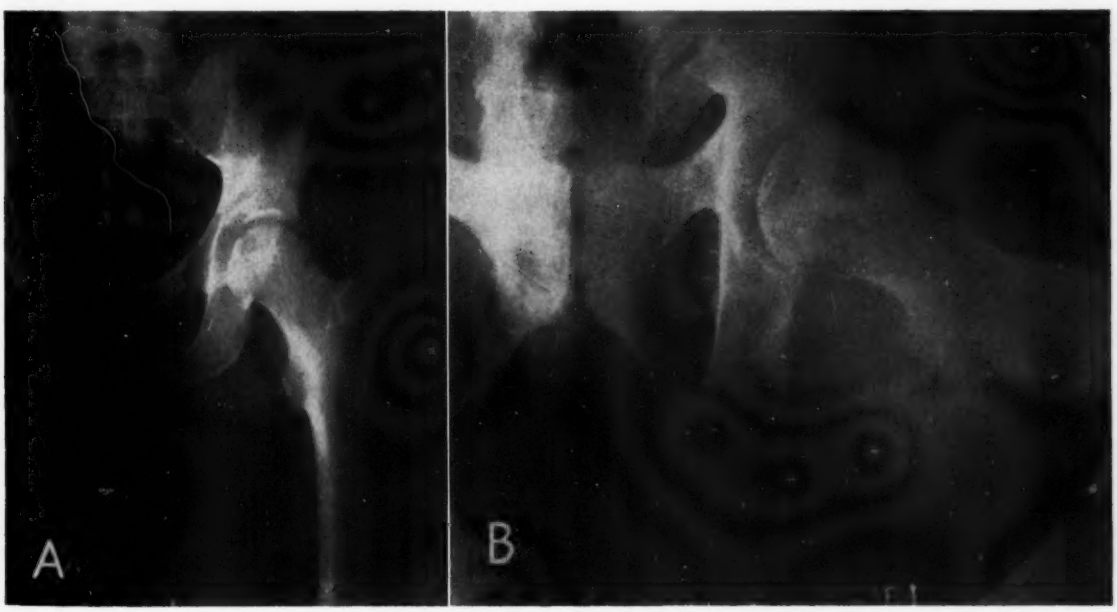

Fig. 2. (*A*) Anteroposterior and (*B*) lateral views of hip joint approximately two months following injury. Infectious process in hip is becoming apparent.

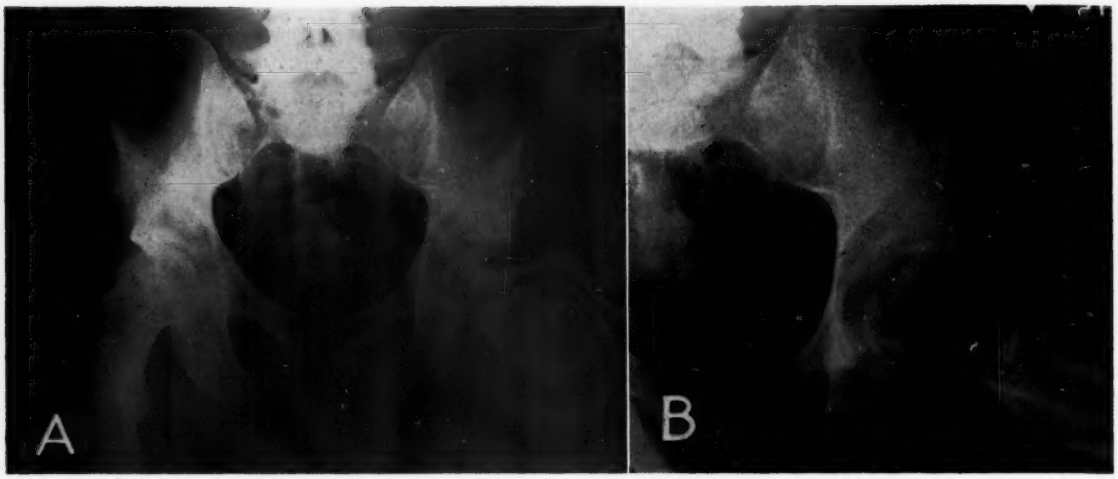

FIG. 3. (*A*) Anteroposterior and (*B*) lateral views of hip showing destruction of bone and joint cartilage taken approximately three months after injury.

the leg and sedatives were given, which resulted in very little relief. Temperature ranged from 98 to 99.6° F. He was dismissed six days after admission (Fig. 2).

His second admission was February 4, 1942, approximately three months after his injury (Fig. 3). A roentgenogram of the chest was normal. Agglutination reactions were negative with the exception of that for *Bacillus abortus* which was positive in all dilutions through purified protein derivative, strength No. 1, which was negative, and strength No. 2, which was mildly positive. The hip was immobilized by a cast and he was discharged eighteen days after admission.

His third admission was March 17, 1942 (Fig. 4), at which time the roentgenologist made a diagnosis of brucellosis of the left hip. On May 18, 1942 (Fig. 5 and 6) the cast was removed and the roentgenogram revealed a healed septic arthritis of the left hip, caused by undulant fever. However, the roentgenogram taken on September 4, 1942 (Fig. 6), showed an

FIG. 4. Anteroposterior view of hip approximately five months after injury, showing beginning of infectious process of hip.

FIG. 5. Anteroposterior view of hip taken seven months after injury, showing further healing of hip.

area in the upper third of the shaft of the femur that indicated the presence of bone infection in this portion of the femur, although the infection in the head of the femur had completely healed (Fig. 7). The examination of this patient consisted of stereoroentgenograms showing both hip joints, so that they might be compared, and a lateral view through the left hip joint. In comparison with previous examinations, the last of which was September 4, 1942, there seemed to be very little difference in the appearance of the bone structure. Apparently repair had reached a stationary stage, so far as the head of the femur was concerned. The area of lessened density in the shaft of the femur also showed evidence of some change. This was barely covered by the examination, but showed increase in density and less evidence of bone involvement. The same was true with the area of lessened density over the greater trochanter of the femur. The agglutination reaction was still positive for *Bacillus abortus*. Macroscopic agglutination reactions were positive in all dilutions. On April 7, 1945, the agglutination reaction for undulant fever was still positive and there was absence of clinical or roentgenological evidence of the disease in the left hip.

Fig. 6. Anteroposterior view of hip taken on September 4, 1942, indicates further healing at hip joint but area in upper third of femur indicates that there is still an area of bone disease present.

SUMMARY

It has been the purpose of this brief paper to present a case of brucellosis involving the hip joint and to discuss, briefly, the occurrence, diagnosis and the treatment of brucellosis infection of the bones and joints.

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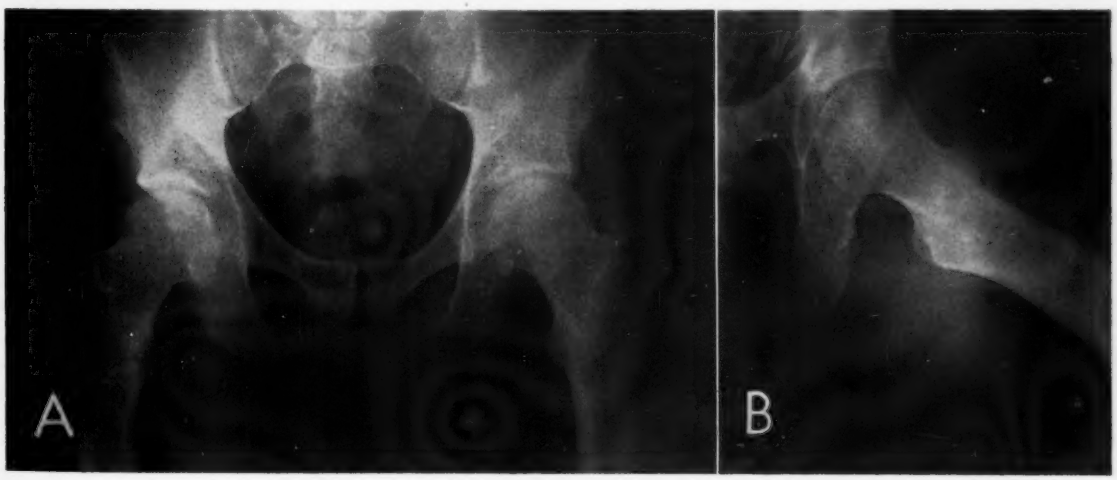

Fig. 7. (*A*) Anteroposterior and (*B*) lateral views of hip taken on January 30, 1943, one year and three months after injury, showing complete healing of infectious process in hip joint, and the area previously noted in the upper third of the shaft of the femur in Figure 6 has practically disappeared.

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Vol. 66, No. 6

PREMALIGNANT LESIONS OF THE GASTROINTESTINAL TRACT

I. THE SIGNIFICANCE OF ROENTGENOLOGIC EVIDENCE OF HYPERTROPHIC GASTRITIS*

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CANCER of the stomach is known to be one of the great killers of our day. In 1946 the number of reported deaths from this disease in the United States was 26,000. If one adds to this figure the probability of an equal mortality which is not reported, one arrives at a conservative estimate of 50,000 persons dying each year of gastric cancer.

When one considers the efficacy of therapy for this condition the findings are gloomy indeed. In spite of the outstanding surgical efforts in a few large medical centers, the over-all absolute five year survival rate for the country as a whole is about 5 per cent, and it seems unlikely that any significant improvement in this rate of survival will be made for a long time to come by any present day therapeutic methods, in spite of increasing skill in surgical techniques, chemotherapy and antibiotics, and better preoperative and postoperative care.

In recent years a great deal of effort has been expended to educate physicians and laymen in the need for, and the methods of, early diagnosis of cancer, including cancer of the stomach. It is taught that if more patients presented themselves with a small or early cancer of the stomach a great many of these individuals would remain cured after the tumor was removed.

Furthermore, the diagnosis of carcinoma of the stomach is almost entirely a roentgenological problem. The observations and wisdom of many radiologists during the past fifty years serve as a basis upon which the diagnosis of a well established tumor in the stomach can easily be made. On the other hand, the identification of small or early lesions in the stomach is often an extremely difficult or impossible task even for the careful and experienced examiner. Since it is the *early* lesion which must be found in order to improve the five year survival rate in cancer of the stomach, and since it is the *early* lesion which often escapes detection by the roentgenological examination, it may be necessary to look elsewhere for help in the problem of gastric malignancy.

Numerous reports in the literature have dealt with the characteristics of chronic hypertrophic gastritis. Excellent reviews of the correlation between gastroscopic and roentgenographic observations have been contributed by Berridge,[1] Dow,[3] Vaughan,[12] and Walk.[13] Clinical and surgical aspects of this subject appear in papers by Eusterman,[4] Brunn and Gold,[2] and Faber.[5] The difficulty of distinguishing between hypertrophic gastritis and cancer of the stomach has been emphasized by Freedman *et al.*,[7] Pollard and Cooper,[10] Maimon *et al.*,[9] and Torgersen.[11] With this background of information, it is important to examine further into the relationship of chronic hypertrophic gastritis and cancer of the stomach to see whether clinical experience will help in establishing hypertrophic gastritis as a premalignant lesion.

This material is comprised in the following case reports:

REPORT OF CASES

CASE I. G. P., white male, aged fifty-five complaining of dyspepsia and epigastric pain of several years' duration. Various diets afforded only temporary relief. No vomiting, bleeding or significant weight loss.

Physical and laboratory examinations showed

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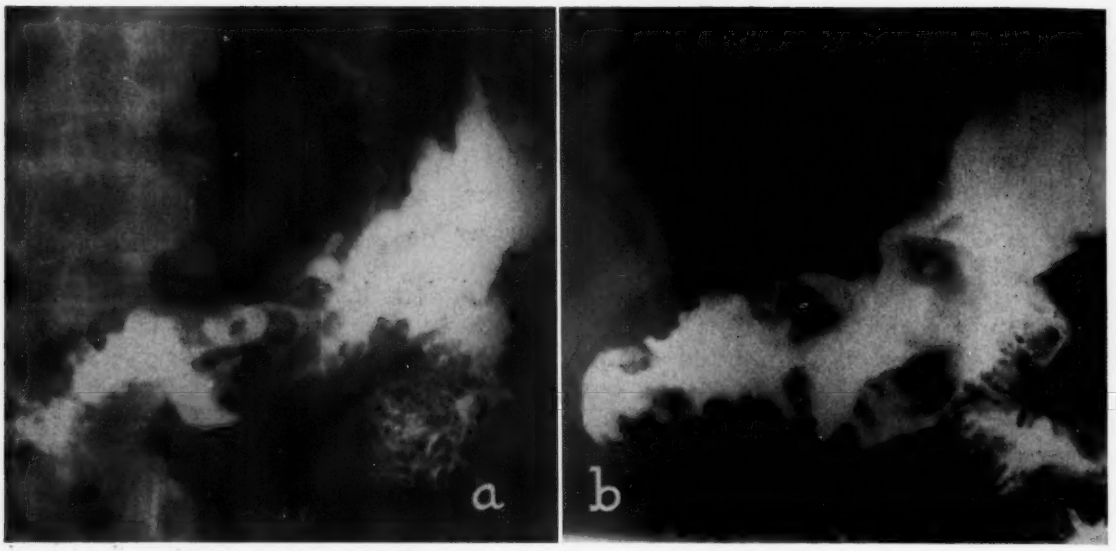

FIG. 1(*a*) Case I. Roentgenogram of the stomach of a fifty-five year old white male with dyspepsia and epigastric pain of several years' duration. Note the marked enlargement and irregularity of the rugal folds in the distal half of the stomach. This was diagnosed carcinoma and proved to be benign chronic hypertrophic gastritis.

FIG. 1(*b*) Case II. Roentgenogram of the stomach of a fifty-one year old white male with weight loss, epigastric pain and occasional vomiting and tarry stools of one year's duration. Note the change in the mucous membrane of the distal half of the stomach and compare with Figure 1(*a*). This was diagnosed carcinoma and was proved to be such.

no cause for the symptoms. Roentgen examination disclosed marked changes in the mucous membrane of the stomach with irregular, giant rugae in the lower third (Fig. 1*a*). This was interpreted as carcinoma. No gastroscopic study was done.

A partial gastric resection was performed and examination of the specimen disclosed extensive hypertrophic gastritis with no evidence of neoplasm.

CASE II. R. G., white Latin American, aged fifty-one, with weight loss, anorexia, epigastric pain and occasional vomiting of one year's duration. Tarry stools.

Physical examination showed an indefinite mass in the upper mid-abdomen. The hemoglobin was 37 per cent. Roentgen study revealed great distortion and enlargement of the rugae in the lower half of the stomach and the diagnosis was carcinoma (Fig. 1*b*).

A subtotal gastric resection was done. The liver and lymph nodes appeared free of disease. The pathological specimen showed extensive carcinoma infiltrating the mucosa and submucosa up to the line of resection. Microscopic study showed multiple foci of carcinoma, apparently arising independently, with diffuse gastritis and cellular metaplasia throughout the mucosa.

Comment. These 2 cases illustrate the fact that chronic hypertrophic gastritis and carcinoma of the stomach may be indistinguishable by roentgen examination, and that, in both, the appearance of the stomach is very abnormal.

CASE III. H. M., white male, aged fifty-eight, complaining of post-prandial pain, not relieved by antacids, of two years' duration. Recently this had become gnawing and constant in character. There had been no nausea, vomiting or bleeding. He lost 15 pounds in weight in six months. Previous roentgen studies and gastroscopy had shown a diffuse chronic hypertrophic gastritis and this was confirmed by repeating these procedures (Fig. 2, *a*, *b* and *c*).

Physical examination revealed a pelvic mass extrinsic to the rectum.

At operation there was found a large, hard, immobile mass extending back from the lesser curvature of the stomach near the pylorus. Metastatic nodules were present in the omen-

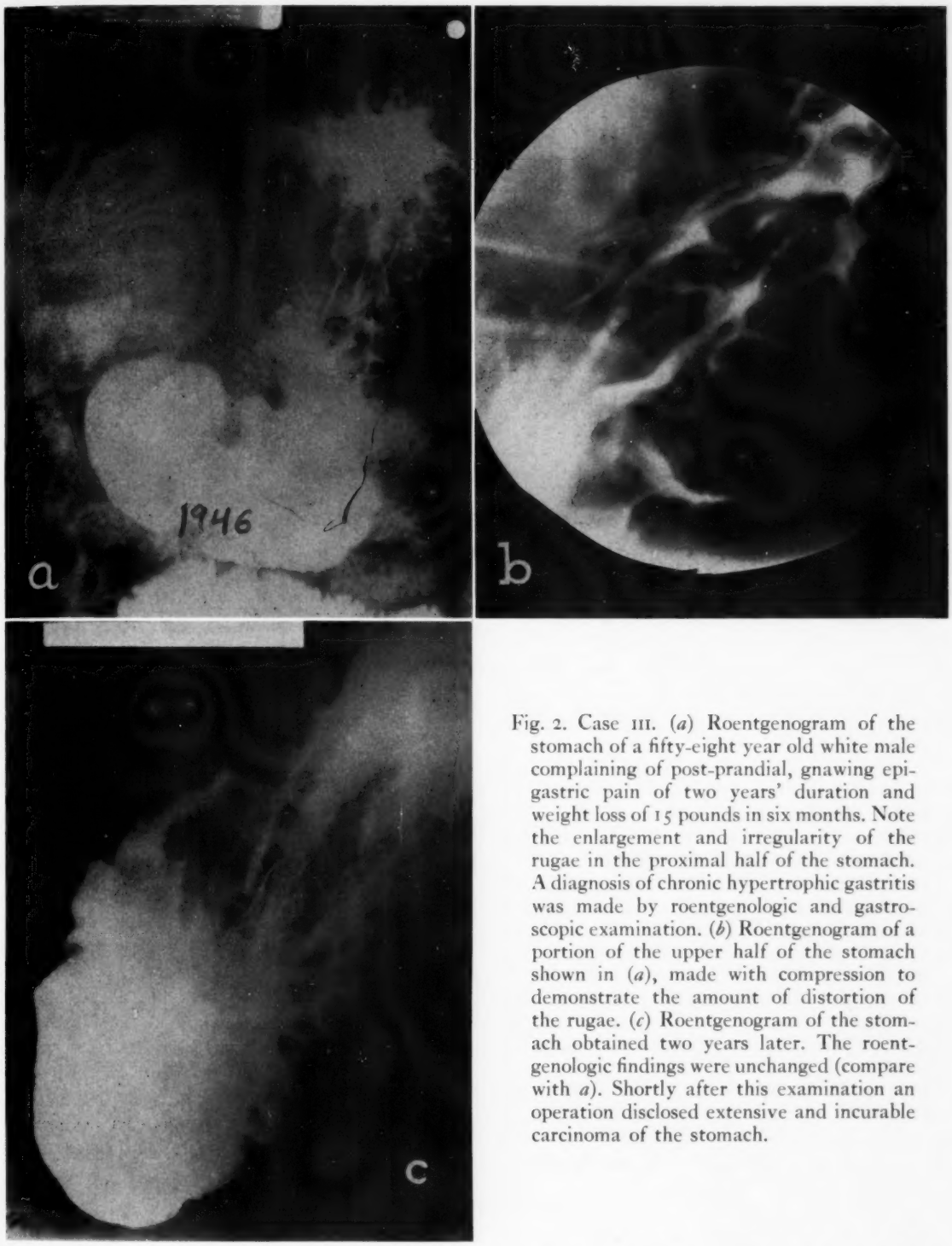

Fig. 2. Case III. (*a*) Roentgenogram of the stomach of a fifty-eight year old white male complaining of post-prandial, gnawing epigastric pain of two years' duration and weight loss of 15 pounds in six months. Note the enlargement and irregularity of the rugae in the proximal half of the stomach. A diagnosis of chronic hypertrophic gastritis was made by roentgenologic and gastroscopic examination. (*b*) Roentgenogram of a portion of the upper half of the stomach shown in (*a*), made with compression to demonstrate the amount of distortion of the rugae. (*c*) Roentgenogram of the stomach obtained two years later. The roentgenologic findings were unchanged (compare with *a*). Shortly after this examination an operation disclosed extensive and incurable carcinoma of the stomach.

tum. The pathological report was carcinoma.

Case IV. A. M., white male physician, aged fifty-five, with history of epigastric burning and uneasiness relieved by antacids and food. He had had a bleeding duodenal ulcer eighteen years before.

Physical examination was not contributory. Roentgen study on three occasions showed enlarged, irregular rugae in the lower half of

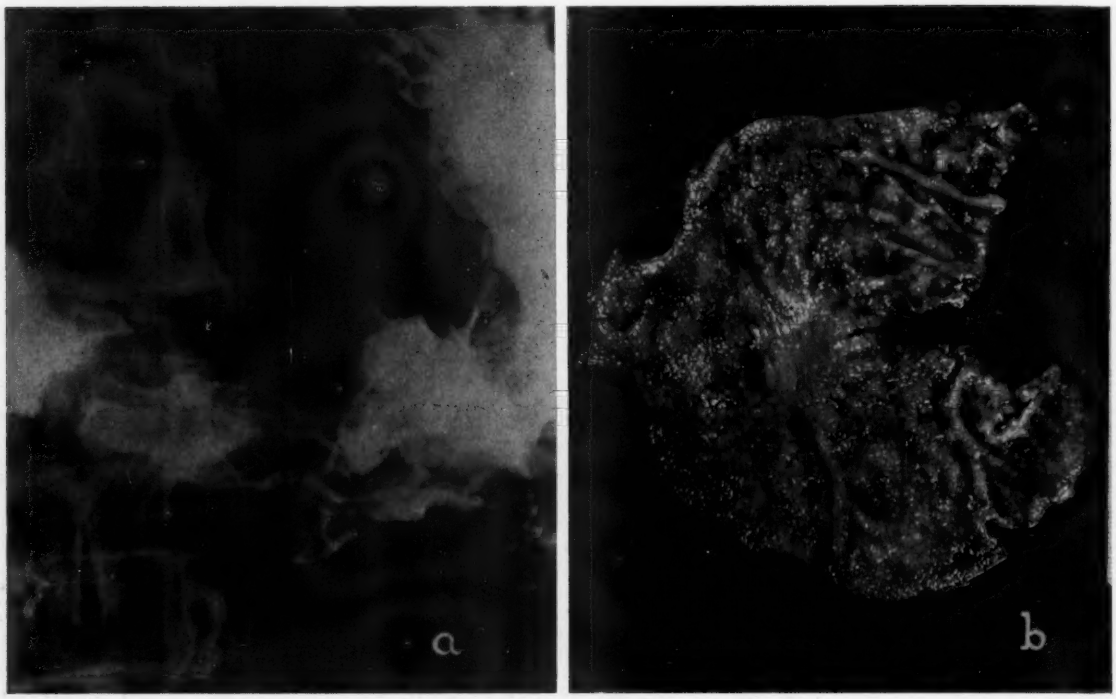

FIG. 3. Case IV. (*a*) Roentgenogram of the stomach of a fifty-five year old physician complaining of epigastric burning and uneasiness of six months' duration. Note the changes in the rugal folds in the distal half of the stomach. The margin of the lesser curvature was thought to be stiffened. Because of the possibility that carcinoma was present a partial gastric resection was done. (*b*) Photograph of the gross specimen removed at operation. This showed extensive chronic hypertrophic gastritis with no evidence of carcinoma.

the stomach with stiffening of the lesser curvature. There was scarring of the duodenal cap (Fig. 3*a*). Although the roentgen diagnosis was gastritis, it was felt that carcinoma could not be excluded. Gastroscopic examination was reported as showing "patchy gastritis."

A partial gastric resection was done. The specimen showed enlarged rugal folds infiltrated with chronic inflammatory cells and no evidence of carcinoma (Fig. 3*b*).

Comment. These 2 cases suggest the premalignant character of chronic hypertrophic gastritis. Case IV was operated upon after six months of symptoms, and had gastritis only. Case III was not operated upon until after two years of symptoms and had gastritis and carcinoma.

CASE V. (Kindness of Dr. Philip J. Hodes.) M. B., white female, aged thirty-five, complaining of dyspepsia of two years' duration. Diet and antacids gave only temporary relief. Physical examination was negative.

The first roentgen study showed an area of localized hypertrophic gastritis in the upper one-third of the stomach. No ulcer was seen. The second roentgen examination, two years later, disclosed an extensive infiltrating carcinoma of the lesser curvature and this was proved at operation (Fig. 4, *a* and *b*).

CASE VI. (Kindness of Dr. Ross Golden.) C. E., white male, aged fifty, complaining of indefinite gastric symptoms for several years. Physical examination was not contributory.

Several roentgen studies of the stomach were done over a period of four years. During this time he was thought to have hypertrophic gastritis. The last roentgen examination disclosed two shallow ulcerations in the stomach which were thought suggestive of carcinoma (Fig. 5, *a*, *b* and *c*).

Operation revealed an extensive infiltrating carcinoma of the linitis plastica type which was inoperable.

Comment. In both Case V and VI, the patient was under careful medical supervision for a long period of time. Repeated, painstaking roentgen investigation demonstrated definite organic disease in the stomach. Either when the patients were first seen, or while they were under observa-

tion, carcinoma existed. Because the roentgen findings were identical with hypertrophic gastritis, the correct diagnosis was not made until it was too late. There was no way in which the lives of these patients could have been saved unless a gastric resection had been done when the diagnosis of chronic hypertrophic gastritis was first entertained.

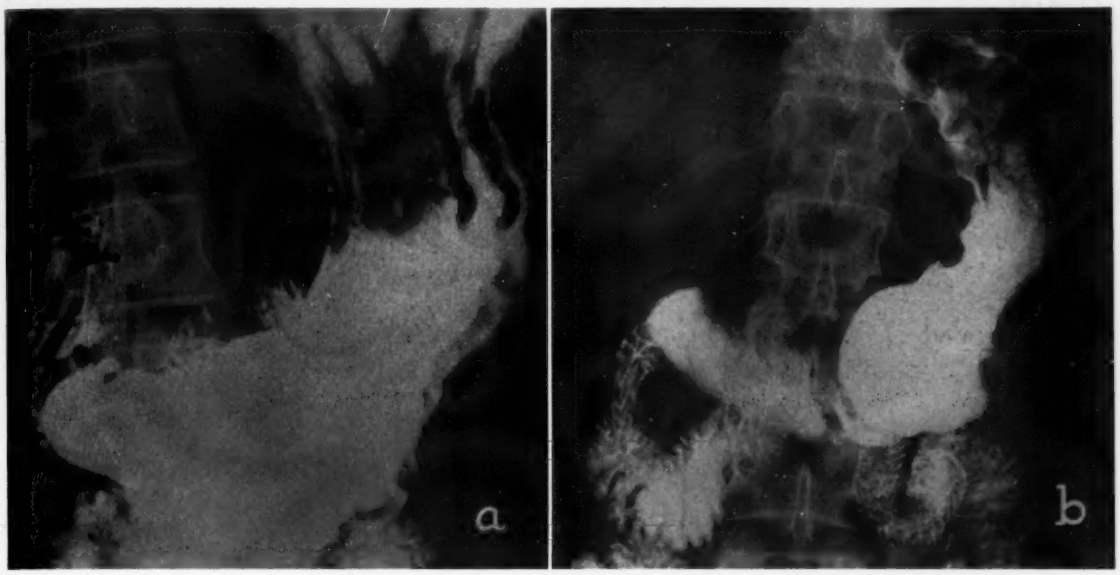

Fig. 4. Case v. (Kindness of Dr. Philip J. Hodes.) (*a*) Roentgenogram of the stomach of a thirty-five year old white female complaining of dyspepsia of two years' duration. Note the localized swelling of the gastric rugae just below the cardia. This was interpreted as localized chronic hypertrophic gastritis. (*b*) Re-examination two years later disclosed an extensive infiltrating carcinoma of the lesser curvature which was found incurable at operation.

DISCUSSION

Chronic hypertrophic gastritis represents an irritative state which is probably irreversible. Among the inciting and sustaining causes, one may mention excessive use of alcohol and tobacco, disturbances in function of gastric glands, peptic ulcer, allergy, and, by no means least, psychic factors.

The microscopic pathology ranges from a simple inflammatory picture to one where the gastric glands are hypertrophied and irregular, with cyst formation and metaplasia of the lining epithelium. The analogy between this appearance and known premalignant changes in other organs, such as the breast and uterus, is very suggestive.

Although gastroscopic and pathologic studies in gastritis indicate that there are several different types which may be recognized (atrophic, superficial, hypertrophic, phlegmonous, etc.), these distinctions cannot be made by the roentgenological examination. It seems best to limit the roentgen diagnosis to a condition in which one can demonstrate definitely or markedly enlarged and irregular rugal folds throughout the stomach or localized to a portion of it. The finding of "stiffness" or lack of change in these folds may indicate extensive infiltration of them by inflammatory elements as opposed to edema alone, but this quality of stiffness is difficult to demonstrate adequately unless it is a very marked feature and should not be considered an essential characteristic of the roentgenological picture.

It has been shown by Golden and Stout[8] that superficial spreading carcinoma of the stomach can produce a very similar roentgen appearance. Indeed, these authors have stated that some patients with chronic hypertrophic gastritis have been followed for several years and eventually operated upon with the finding of carcinoma. Our experience has been very similar as illus-

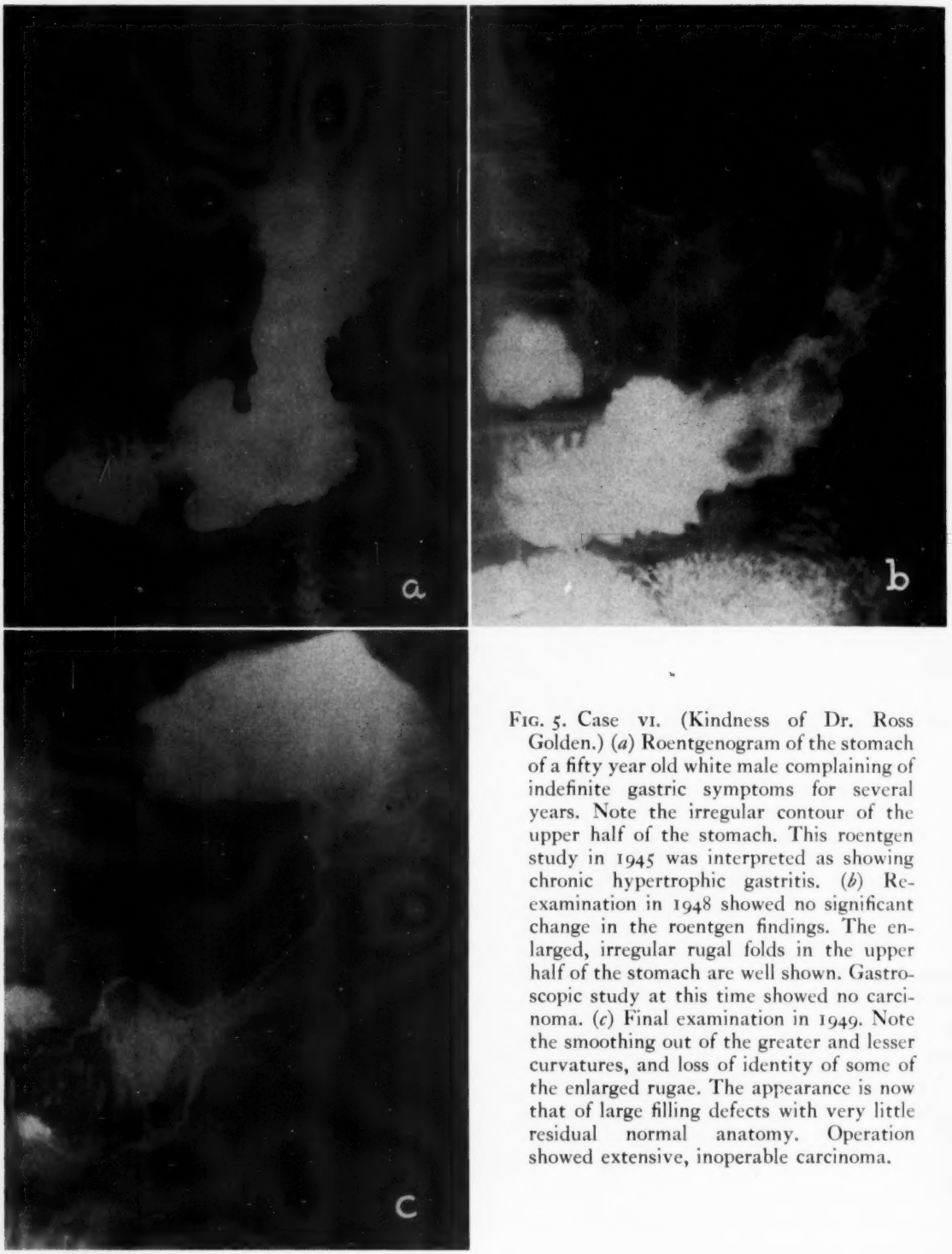

Fig. 5. Case vi. (Kindness of Dr. Ross Golden.) (*a*) Roentgenogram of the stomach of a fifty year old white male complaining of indefinite gastric symptoms for several years. Note the irregular contour of the upper half of the stomach. This roentgen study in 1945 was interpreted as showing chronic hypertrophic gastritis. (*b*) Re-examination in 1948 showed no significant change in the roentgen findings. The enlarged, irregular rugal folds in the upper half of the stomach are well shown. Gastroscopic study at this time showed no carcinoma. (*c*) Final examination in 1949. Note the smoothing out of the greater and lesser curvatures, and loss of identity of some of the enlarged rugae. The appearance is now that of large filling defects with very little residual normal anatomy. Operation showed extensive, inoperable carcinoma.

trated by the case reports included above. This means that either cancer of the stomach may exist in an extensive form for a remarkably long period as suggested by Feldman[6] or that it may develop coincidental with, or as a result of, chronic hypertrophic gastritis. Furthermore, contrary to the opinion of Berridge[1] and others,

the hazard of carcinoma exists whether the gastritis is limited to the antrum or involves the entire stomach.

When carcinoma develops in association with chronic hypertrophic gastritis, it may spread extensively throughout the submucosa of the stomach without producing ulceration or projecting tumor. In this silent and insidious manner, the entire stomach may be permeated before the symptoms or roentgen signs of definite carcinoma appear. It is this spread of carcinoma without additional concomitant change in form or function of the stomach, which makes its detection by roentgenologic and gastroscopic means exceedingly difficult or impossible.

Since a significant improvement in the five year survival rate cannot be expected by the roentgenological detection of early cancer of the stomach, and since an unpredictable number of patients with chronic hypertrophic gastritis diagnosed by roentgenological methods will develop cancer of the stomach without any change in the roentgen picture, prophylactic resection of the stomach of all patients with roentgen evidence of chronic hypertrophic gastritis should be considered. This concept presents a difficult decision to internists, gastroenterologists, and surgeons because present knowledge does not indicate how many of these patients will suffer unnecessary or non-therapeutic gastrectomies, and how many will be spared a subsequent carcinoma. Nevertheless, with the present limitations in our understanding in regard to adequate diagnosis and treatment of gastric carcinoma it seems inescapable that a different and perhaps more radical approach to the problem should be undertaken. The surgical management of chronic hypertrophic gastritis might be one step in this direction.

Lastly, it is interesting to note that in attempting to contribute to the solution of the problem of cancer of the stomach, one has raised new questions for which no answer is yet available. The proper assessment of the statistical probability of a patient with chronic hypertrophic gastritis developing a gastric neoplasm, and comparison of this hazard with that associated with gastrectomy, is a contribution which the future must provide.

CONCLUSION

Evidence in the literature, and the clinical experience outlined in this paper indicate that, in some instances, it is impossible to distinguish chronic hypertrophic gastritis from carcinoma of the stomach. Furthermore, an unpredictable number of patients with hypertrophic gastritis of several years' duration will develop carcinoma. For these reasons prophylactic gastrectomy should be considered in all patients with this premalignant lesion.

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GLYCOGEN DISEASE*

REPORT OF TWO CASES WITH CARDIOMEGALY

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GLYCOGEN disease is uncommon but is of sufficient importance to be considered in the roentgen differential diagnosis of enlargement of the liver, heart and kidneys during infancy and childhood. The purpose of this presentation is to describe the roentgen and clinical findings in 2 patients with cardiac enlargement due to glycogen disease, and to point out the role of angiocardiography as an aid in the diagnosis.

ETIOLOGY

Glycogen disease was first recognized by von Gierke[7] in 1929 and is a condition in which large amounts of glycogen are deposited in the liver, heart, kidneys, striated muscle, adrenals and in almost all of the other body tissues except integument and bone. The etiology remains obscure but many observers believe it is familial in character.[6,11,13] Abramson and Kurtz[1] describe the occurrence of 4 cases in one family and suggest that the factor for transmission may behave like a mendelian recessive.

CLASSIFICATION

Swiss authors[10] from the University of Basel have suggested an anatomical classification based upon the organs involved. They describe four types:

1. Liver and kidneys.
2. Liver, heart and skeletal muscle with no kidney involvement.
3. Heart with possible slight liver involvement.
4. Heart, tongue, skeletal and smooth muscle.

A fifth type was described by Kimmelstiel[8] who observed involvement of the brain and spinal cord. The usual clinical classification, however, includes only the hepatic and the cardiac types, and further subdivision depends upon autopsy findings.

ABNORMAL PHYSIOLOGY

There have been several theories concerning the abnormal physiology of glycogen disease. The earlier authors believed that the basis of this disorder was the deposition of an extraordinarily stable type of glycogen, often designated as the "fetal" type. Recent revision of the understanding of glucose metabolism has led others to believe that there is a defect in the enzymatic processes involved in glycogenolysis. Thannhauser *et al.*[12] state that the alkaline phosphatase activity is lower than in normal livers and that such a decrease would favor storage of glycogen by retarding glycogenolysis.

A third group believes that a secondary reaction assumes the primary role in glycogenesis in this disease. Mason and Andersen[9] believe the liver is unable to fix glucose, but builds up abnormal glycogen stores from absorbed levulose and galactose. Crawford[5] indicates the usual reaction: glucose→glycogen→glucose, is replaced in this condition by a usually secondary reaction; glucose→fat→glucose +ketone bodies. Bridge and Holt[2] agree with the abnormal conversion of carbohydrate to fat but state that blood sugar levels may be maintained by protein gluconeogenesis.

A Swiss group[10] postulates a central nervous system origin on the basis of experiments which demonstrate that ergotamine and atropine paralysis of sympathetic and parasympathetic endings lead to a decrease in alimentary blood sugar elevation with an increase in liver glycogen.

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CLINICAL LABORATORY FINDINGS

The clinical laboratory findings are of importance in establishing the diagnosis in the hepatic form of the disease. Ketonuria without glycosuria, asymptomatic hypoglycemia, flat glucose tolerance curves and minimal or no elevation of the blood sugar following the parenteral administration of epinephrine are almost constant observations. Crawford[5] has described increased blood glycogen levels while Cohen[4] and others have demonstrated starch in the feces. Mason and Andersen[9] have observed an abnormal response to levulose and galactose tolerance tests in one of their patients.

These abnormal laboratory findings, however, have not been reported positive in the cardiac form of the disease. Bridge[3] believes that the same type of disturbance is in operation in both types of the disease, but the differences observed in the clinical laboratory examinations depend on the distinctive physiological functions of the organs involved.

PHYSICAL FINDINGS

The onset of the disease is usually between the ages of four to twelve months when weakness and feeding difficulties are noted. The physical findings include enlargement of the liver, heart or kidneys. In cases of primary liver involvement, the hepatomegaly is quite striking. Splenomegaly is not present and is important in the differential diagnosis of those diseases such as the reticuloses, hemolytic anemias, lymphomas and rheumatoid arthritis in which enlargement of the spleen and liver are identified. Hepatomegaly without splenomegaly may also be found in cirrhosis, primary carcinoma of the liver and metastatic involvement by neuroblastoma. Cohen[4] mentions that there may be a history of jaundice.

The physical findings in the cardiac type are related either to cardiac insufficiency with edema and cyanosis or to the respiratory system where varying degrees of distress may be noted. In some instances, the respiratory symptoms may be the most prominent feature and especially so when there is compression of the bronchi with atelectasis and repeated bouts of pneumonia. Symptoms referable to hypoglycemia have not been reported in the cardiac form of the disease. Of importance in the differential diagnosis is the rare occurrence of a murmur in the cardiac form and the absence of ascites in the hepatic form. Kimmelstiel[8] has described cerebral signs and symptoms which were later proved to be due to deposits of glycogen in the brain and spinal cord.

PATHOLOGY

The most important gross observation at autopsy is enlargement of the organs involved. The heart may be two to five times larger than normal and pale or bright red in color. The liver may be pale or yellow due to the presence of fat. The other organs are usually swollen or pale. The microscopic sections stained with Best's carmine reveal the inclusion of large amounts of red-staining glycogen within distended vacuolated cells. The muscle fibers of the heart may be so distorted that positive identification is difficult. In the liver, the glycogen is deposited in the hepatic and Kupffer cells—the latter being the less common site. Many of the cases with cardiomegaly have shown an increase in the glycogen content of skeletal muscle and, on this basis, biopsy has been suggested as a diagnostic procedure. Normal glycogen levels in skeletal muscle, however, do not exclude the disease. van Creveld[14] analyzed tissues in proved and control cases and set up tables of per cent glycogen per organ weight which are used as standards in this institution.

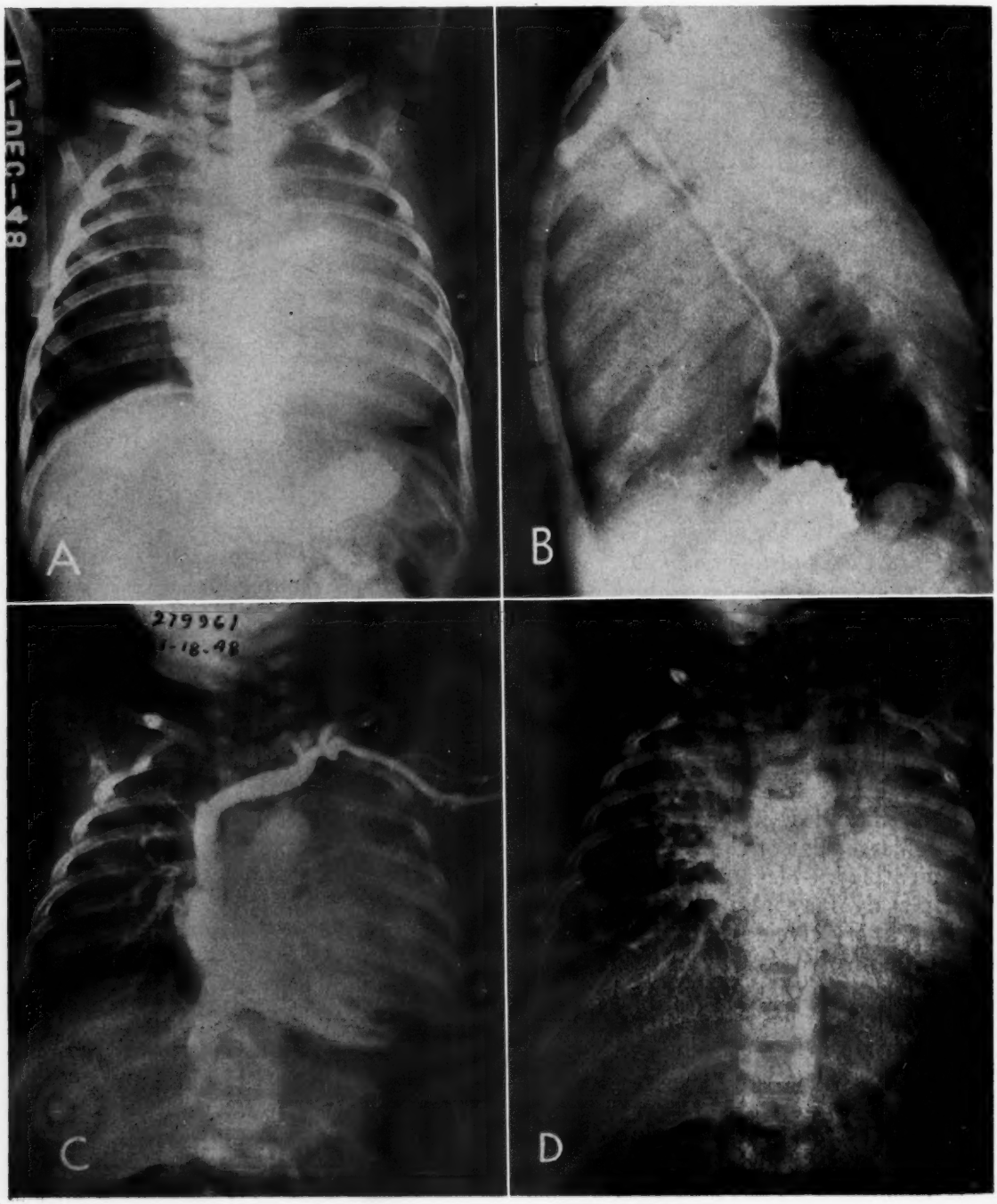
CASE REPORTS

Five patients with this disease have been observed at Babies and Childrens Hospital in the past ten years. Cardiac enlargement was identified in 2 cases.

Case 1. J. F., a white male, aged four months, was admitted to the hospital with a complaint of upper respiratory infection and refusal to take feedings. He had been normal at

birth and until the age of two months at which time he developed cough and anorexia. A chest roentgenogram made elsewhere was interpreted as bronchopneumonia. He received penicillin therapy but the cough persisted. There was no history of dyspnea or cyanosis. The pregnancy had been normal except for a threatened abortion at three months. A first pregnancy had been terminated in abortion in the same length of time. The family history was otherwise non-contributory.

The patient was a well developed, poorly nourished infant who appeared chronically ill. He had a deep-seated loose cough. The left side of the chest was dull to percussion and breath sounds were absent except over the



base where there was a constant expiratory wheeze. No rales were heard. The heart was enlarged to percussion to the left anterior axillary line but no murmurs were heard.

The erythrocyte and leukocyte counts were normal. The phenolsulfonphthalein excretion was normal. The tuberculin test (1:1000) and the serologic test for syphilis were negative. The urine was negative for ketone bodies. The electrocardiogram suggested left ventricular hypertrophy. Chest roentgenoscopy and roentgenograms revealed an increased respiratory rate with a slightly diminished excursion of the diaphragm. The cardiac silhouette was enlarged throughout (Fig. 1*A*) and the left margin extended to the lateral chest wall. The lower half of the trachea was slightly narrowed and was displaced posteriorly (Fig. 1*B*). A homogeneous density obscured the left upper lung, and the left main stem bronchus was narrowed. The shadow was thought to represent atelectasis of the left upper lobe. The infant was discharged after recovery from the upper respiratory infection to return at a later date for further studies.

The patient was readmitted to the hospital at the age of five months because of a recurrent upper respiratory infection and difficulty in breathing. His mother had noted, however, that the respiratory distress was relieved when he had been placed in the prone position or on the right side. A course of roentgen therapy was given to the thymus gland because of the persistence of the cough and the atelectasis in the left upper lobe.

The therapy proved ineffectual in altering the patient's symptoms or relieving the respiratory distress and he was readmitted at the age of six months. Angiocardiography revealed a normal mode of circulation of the contrast medium through the heart and great vessels. The smaller branches of the pulmonary artery in the left lung were closer together than those in the right and the more peripheral segments were not well visualized, suggesting a decrease in the volume of the entire lung. There was no enlargement of the main pulmonary arteries, but the left was slightly elevated (Fig. 1*C*). The right auricle and ventricle appeared normal. The left ventricular wall was thickened and the chamber was slightly dilated (Fig. 1, D and *E*). The aorta was normal in size and position. Bronchoscopy revealed compression of the left main stem bronchus by extrinsic pressure. An exploratory thoracotomy was undertaken in an effort to determine the cause and to relieve the obstruction of the left main stem bronchus. An enlarged, pale heart was seen, and there was a slight constriction of the aorta just distal to the point of origin of the left subclavian artery. The left main stem bronchus was almost completely occluded by

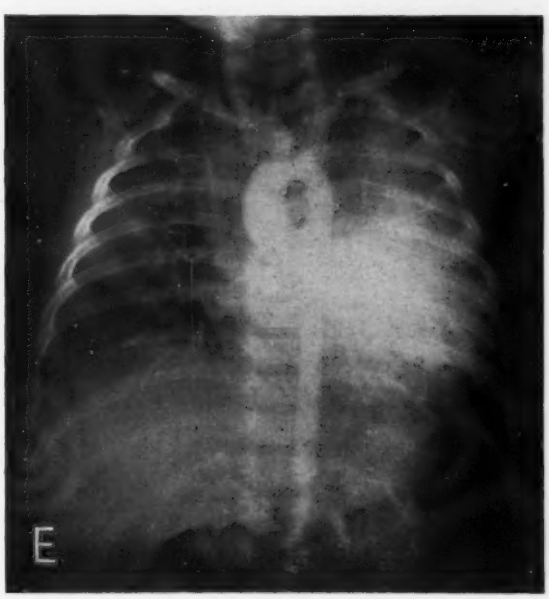


Fig. 1. Case 1. (*A*) Anteroposterior and (*B*) lateral roentgenograms of the chest in an infant with glycogen disease. There is marked cardiac enlargement and atelectasis in the left upper lobe. The lateral projection reveals marked posterior enlargement of the heart and displacement of the esophagus and trachea. (*C*) Angiocardiogram made in the anteroposterior projection. The study demonstrates filling of the right side of the heart and slight upward displacement of the pulmonary artery. (*D*) Angiocardiogram demonstrates the vascular pattern of the left upper lobe which is consistent with atelectasis. The left ventricular wall is thickened. (*E*) Angiocardiogram demonstrates a normal aorta and vascular pattern of the great vessels arising from the arch. The thickness of the left ventricular wall is again demonstrated.

FIG. 2. Case II. Anteroposterior roentgenogram of the chest in an infant nine weeks old with glycogen disease. Marked cardiac enlargement is present and the left margin of the heart extends to the lateral chest wall.

the left pulmonary artery and both structures were displaced superiorly by the enlarged heart. The left upper lobe was atelectatic. At this point, a tachycardia developed and progressed to a flutter. Attempts at resuscitation failed.

The necropsy revealed marked deposition of glycogen in the myocardium of the heart, which was pale and thickened. The heart weighed 185 gm. as compared to an expected weight of 31 gm. The wall of the left ventricle measured 10 mm. in thickness and the right ventricle 3 mm. The liver was moderately enlarged (weight 330 gm. and expected weight 200 gm.) and glycogen deposits were seen within its cells. There was also a high content of glycogen in the striated muscle of the diaphragm. The kidneys were involved, but to a lesser degree. There was marked hyperplasia of the islet cells of the pancreas and the cells were vacuolated. Atelectasis was present in the left upper lobe and the lingula. Table I shows the glycogen content.

CASE II. L. D., a white female infant, was admitted to the hospital at the age of nine weeks because of failure to gain weight. She had been delivered by cesarean section because of toxemia which developed during the last two weeks of pregnancy. At birth and constantly thereafter, the infant presented a mottled erythematous rash over the entire right side of the body. The family history was noncontributory.

The physical examination revealed a well developed and well nourished white female infant who appeared acutely ill with rapid and labored respirations. A mottled erythematous rash extended over the right side of the body and terminated abruptly at the midline anteriorly and posteriorly. The rash became a deeper red when the baby cried, and at times appeared cyanotic to some observers. The heart was enlarged to percussion to the left anterior axillary line. The rate was rapid (180) and no murmurs were heard. After admission, the liver was found to be palpable and firm.

The hemogram revealed 3.73 million erythrocytes and a hemoglobin of 70 per cent. The admission urinalysis was negative for ketone bodies but contained 2 plus albumin and many pus

TABLE I

GLYCOGEN CONTENT

	van Creveld's[14] case	Autopsy No. 10408	Normal
Heart	7.96%	5.4%	0.05–.07%
Liver	9.13%	4.9%	0.10%
Skeletal muscle	9.39%	6.1%	0.01%

cells. The chest roentgenogram (Fig. 2) revealed marked enlargement of the cardiac silhouette, with the left margin extending to the lateral thoracic wall. A diagnosis of von Gierke's disease was entertained because of the enlarged heart and liver, but the patient died suddenly on the third hospital day before the diagnostic laboratory examinations could be completed.

At autopsy, the heart was bright red in color and appeared uniformly enlarged, with a weight of 90 gm. as compared to an expected weight of 23 gm. The right ventricular wall measured 4 mm. in thickness while the left ventricular wall measured 7 mm. The ventricles were moderately dilated and globular in contour, but the atria were not unusually enlarged. The endocardium revealed marked fibrosis, particularly in the left ventricle. The liver was

not enlarged and weighed 130 gm. as compared to an expected weight of 136 gm. Sections stained with Best's carmine stain revealed marked diffuse infiltration of glycogen in the heart, liver and skeletal muscle. A quantitative analysis done ten hours after demise is recorded in Table II.

TABLE II

	van Creveld's[14] case	Autopsy No. 7647	Normal
Heart	7.96%	3.73%	0.055–0.07%
Liver	9.13%	3.95%	0.103%
Spleen	1.46%	0.67%	0.01%
Skeletal muscle	9.39%	3.37%	0.011%
Lung	0.034%	0.48%	0.034%
Kidney		0.98%	0.062%

ROENTGEN FINDINGS

The roentgen studies are of value in demonstrating the enlargement of the organ involved and the secondary changes they may produce in adjacent structures. Glycogen storage disease is one of the causes of enlargement of the heart in the first year of life and the chest roentgenograms reveal generalized hypertrophy of all the chambers. Angiocardiography was used in Case 1 and a normal mode of circulation of the contrast medium through the heart and great vessels was demonstrated. The chambers of the heart were slightly enlarged and the left ventricular wall was moderately thickened, probably indicating that hypertrophy was a more prominent part of the enlargement than was dilatation of the chambers.

The atelectasis of the left upper lobe and lingula was an important feature in the clinical course of Case 1. This was thought to be due either to congenital bronchostenosis or to compression of the left main stem bronchus by the enlarged heart or possibly by the left pulmonary artery. Oblique projections of the chest revealed a decrease in the caliber of the left main stem bronchus but the densities in the lung made it impossible to outline either the pulmonary artery or the hilar shadows. Slight posterior displacement of the lower third of the trachea was noted on the lateral roentgenogram of the chest. The angiocardiograms fail to demonstrate the presence of an anomaly of the great vessels to explain the compression of the left main stem bronchus but the left pulmonary artery was slightly elevated. The vascular pattern in the left upper lobe was consistent with atelectasis.

The roentgen studies in the hepatic form may reveal a heart of normal size and varying degrees of enlargement of the liver. The kidneys may be displaced and slightly enlarged. The examination offers little specific information except to confirm the clinical findings and to exclude those forms of hepatomegaly in diseases which may produce a palpable mass in the right upper quadrant. The absence of splenomegaly in glycogen disease is an important clinical feature and is useful in excluding those diseases in which enlargement of the spleen and liver are common findings.

DISCUSSION

The clinical diagnosis of the cardiac form of glycogen disease is difficult because of the lack of specific diagnostic laboratory tests. Enlargement of the heart during the first two years of life may be due to congenital developmental anomalies, idiopathic hypertrophy, infections, anemias (of long standing), hypertension, tumors and metabolic abnormalities such as avitaminosis, thyroid deficiency and von Gierke's disease. Many of these may be excluded by clinical observations, routine laboratory procedures, roentgenoscopy and electrocardiography. These methods of diagnosis, however, are not adequate to permit the differentiation of certain congenital defects, idiopathic hypertrophy, rhabdomyoma, and glycogen storage disease.

The roentgen studies are of value in demonstrating the cardiac enlargement and the effect it might have on adjacent organs. In some instances, the cardiac contour is sufficiently characteristic to permit a tenta-

tive diagnosis of congenital heart disease. The use of angiocardiography has been of great value in excluding congenital developmental defects and appears to be adequate except in demonstrating some of the smaller septal defects. As yet, we have not seen reports of such studies in idiopathic hypertrophy and rhabdomyoma so that a discussion of the findings must be delayed until they are forthcoming. It seems likely that the demonstration of a normal mode of circulation and increased thickness of the ventricular walls would also be present in these conditions. The final differential diagnosis must rest upon the demonstration of an increased glycogen content in the skeletal muscle obtained at biopsy or upon the chance finding of evidence of some abnormality in the carbohydrate metabolism.

SUMMARY

Glycogen disease is one of the causes of cardiac enlargement in the first year of life. The value of roentgen studies is stressed with emphasis upon the use of angiocardiography in excluding congenital anomalies and in the evaluation of hypertrophy and dilatation.

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ADDENDUM

Since this paper was submitted for publication, additional cases of glycogen storage disease of the heart have been reported. For an interesting and complete review of the literature and a detailed report of the chemical findings in one case, the following references are recommended.

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THE PRACTICE OF RADIOLOGY IN THE UNITED STATES: FACTS AND FIGURES

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THE distribution of radiological services in the United States has been a matter of concern to the medical profession, hospital administrators, manufacturers of equipment and radiologists for a number of years. Prior to World War II, there was a noticeable shortage of radiologists in some sections of the country. The irregular distribution became even more pronounced when many radiologists entered the Armed Forces. As a result, several large areas throughout the nation were immediately in danger of being cut off completely from competent radiological services. Many radiologists were classified as essential to the welfare of the public and kept in their particular locality. Even though there has been an increase in the number of radiologists since the end of the World War II, this same danger of a shortage of competent consultants in a number of localities looms again due to the present mobilization plans.

At the 1946 meeting of the Board of Chancellors of the American College of Radiology, it was decided that a survey of the distribution of radiologists should be made by the College. At that time, no accurate information was available on the distribution of radiological services in the various communities throughout the United States or on the standards of the radiological consultation rendered, such as the number of radiologists in proportion to the population, to the number of hospital beds, or to the number of other practicing physicians. It was the general opinion then that in the large cities there were sufficient radiologists to meet the demand for their services, but little was known of the supply in the middle-sized cities, small communities and their surrounding areas.

Since 1937, the American College of Radiology has maintained a Professional Bureau to assist radiologists in locating in those communities needing their services, to assist hospitals in securing radiological department directors, and to help the practicing radiologist himself in finding an assistant or a partner.

The task of conducting this survey was assigned to the Professional Bureau as it was felt that the Bureau could be of greater service to the public, as well as to the radiologists, hospitals, and teaching institutions, if it collected and maintained up-to-date figures on the actual distribution of radiological services. The first instructions were that this was not to be a statistical survey but more or less a determination of the needs of some of the isolated areas. As the survey began to take shape, it became quite evident that the project was large and that some statistical data would be necessary if a full and complete report was to be the ultimate aim of the effort. Progress was slow and considerable personal time and energy were spent in obtaining, tabulating, and evaluating data. Publications of the United States Public Health Service, of the American Medical Association, of the national radiological societies, and a few other sources including the files of the Bureau, were used in an effort to obtain information pertaining to the location of radiologists, the number of hospital beds and physicians within certain boundaries, roentgen-ray equipment in various localities, and the average number of roentgenological examinations done annually in each of the various sized hospitals, as well as any other pertinent data which might be of value. The information showing the ratio of physicians, hospitals, beds, etc., to population was already available to us in publications used as source material. The number of

radiologists in each area was also available from the various directories, but it was difficult to determine how many institutions a single radiologist might serve, or how large a territory he might cover for part time service. The questionnaire method of obtaining information was attempted but the response was not great and gave a cross section poll opinion rather than specific data. It soon became evident that many factors were involved in determining the standards of service. For example, in two adjacent towns of approximately the same size with the same hospital facilities and a comparatively equal daily patient census, the activities of their respective radiological departments were at a wide variance. Accurate information regarding the volume of work done in the private office practice of radiologists was practically impossible to ascertain and estimates had to be made from information we were able to get by correspondence with a few individuals in private practice and from the files of the Bureau.

In recent years much has been said and written about the unequal distribution of physicians, with some emphasis on the distribution of specialists. It has been estimated that at the present time there is a need for 1,000 more radiologists and that many of them should be located in the smaller communities. It has also been recognized for some time that the practice of radiology in trade centers of 25,000 population or less is not only influenced by the law of supply and demand but, in many instances, it is an economic problem. Small town and community hospitals are usually in financial difficulties, even in those places where the per capita wealth is high. Their governing boards are frequently not cognizant of the fact that radiology is a highly specialized branch of medicine and not just a photographic procedure by a technician which their family physician will be able to view and interpret accurately. Such a viewpoint often leads to the opinion that radiology should be used for the financial gain of the hospital and not for the diagnostic benefit of the patients and their physicians. However, it must be said that some radiology is better than no radiology at all, but it must also be added that good radiological consultation, even though not on a daily basis, is far better than attempted radiological consultation by an inadequately trained individual.

Through the experience of the Professional Bureau, it is known that exellent financial offers often fail to lure the young radiologist into the smaller communities where he recognizes the fact that his field of consultation will be limited and where he will not have the advantages of the associations offered in a large town. The recently certified radiologists are as well trained as are the men of any other medical specialty. They have kept abreast of the times and many have had at their disposal unlimited equipment of the latest design. For that reason, they are very reluctant to exile themselves to a small ill equipped and understaffed department or to serve a small hospital on a part time basis.

It is therefore obvious why the bulk of radiology is practiced in the cities and the metropolitan areas. In such centers, the medical environment is more receptive to the specialty, and sufficient equipment and trained personnel are always available to do any and all necessary examinations and procedures.

Any rule which holds good for a large institution should also hold true for a smaller one. It has been found that in the small institutions where the proper emphasis has been placed upon the departments of radiology and of pathology, the results anticipated were achieved. With this in mind, it may be said that no one department of a hospital, large or small, is a better criterion upon which to base an opinion of the caliber of medical work done in that institution than the radiological department. Those hospitals having an efficient radiological department which consistently produces accurate diagnoses, maintains a good record system and full time consultation service are, on the whole, good institutions, while those with a mediocre department which

does not function well from a medical standpoint reflect this ineffectiveness throughout the whole hospital.

The latest published figures[7] state that there are 6,572 registered hospitals in the United States and that of these, 4,761 are general hospitals. Of these general hospitals, 2,257 are of 50 beds or less, 991 of 50–100 beds, 786 have 100–200 beds and 727 are of over 200 bed capacity. Nine hundred and twenty-five (925) of each 1,000 patients admitted to hospitals enter a general hospital.

There are at the present time approximately 3,000[16] certified practicing radiologists in the United States and more than two-thirds of them are located east of the Mississippi River. Obviously, there are not enough to staff all the existing hospital radiological departments with a full time consultant even if the volume of work warrants it. Seventy-seven per cent of the hospitals with 50 beds or less have some roentgen-ray equipment and all of the hospitals of 100 beds or over have a department of radiology.

Financial arrangements between radiologists and the institutions they serve are multitudinous and many various factors influence the standards and type of service rendered to those institutions. Equipment, space devoted to the department, personnel, hospital-radiologist relationship, outpatient departments, and the amount of referred consultation work from outside physicians of the community, are only some of the factors. In addition, as already stated, the small hospitals and the small communities are also faced with the problem that there may not be a sufficient volume of work to support a radiologist, and, too, they may not have adequate equipment for complete radiological service.

The number of radiologists in proportion to the number of physicians differs not only in different states but may vary in different sections of a state. Thirty-four per cent of the physicians in this country are located in towns of 25,000 population or less, but only 19 per cent of the radiologists reside in such communities. Fifty-seven per cent of the radiologists practice in cities of over 100,000 where 48.2 per cent of the physicians of the country also practice. Radiologists distribute themselves geographically in much the same manner as other specialists, but they are usually more dependent upon referred patients from other physicians than are most specialists. The practice of radiology in many communities is often confined to the radiological department of the local hospital where the interpretation of the films may or may not be made by a radiologist.

Even though the ratio between physicians and radiologists varies in the different states, the average of both east and west of the Mississippi River is 1 radiologist to every 57 physicians. Further analysis of available figures shows that there is now 1 radiologist to every 42,000 population while in 1931 there was only 1 radiologist to every 122,000 persons. Considering the growth and expansion of the specialty of radiology during the past twenty years, it is safe to assume that more radiological services are being rendered to each of the present 42,000 than were rendered to each of the 122,000 in 1931.

Information was obtained from experienced investigators[19] in the field of the costs of medical care who estimate that the 150,000 practicing physicians render annually 750,000,000 medical services to the 150,000,000 persons in the United States. It is apparent that 430,000 of such services are administered daily to those confined to general hospitals as that figure is the average daily general hospital census. Radiological services rendered to those persons of the population needing such services is given by the 3,000 radiologists devoting full time to the specialty, by the 500 physicians who devote most of their time to radiology, by the second and third year men (600) of the 933 residents in radiology, and by the 31,000 general practitioners and specialists owning their own equipment.

It is estimated that there are about 15 hospital daily admissions per hospital radiologist and of the 2,500,000 persons seen

each day by a physician more than 83,000 of them are referred to a radiologist.

Soon after the Professional Bureau was established, it began to receive inquiries pertaining to the economics of the practice of radiology. These inquiries were not only directed to the Bureau but to the office of the American College of Radiology, and by pooling our available information, we were able to answer most of them. It soon became quite evident that the proper method of computing space requirements, equipment, personnel, remuneration, operating costs, and many other items involved in the inquiries, was not upon a bed capacity or gross income basis. Hospital and government publications using bed capacity for determination of space requirements[13] and needed personnel proved to be wholly inadequate in many places where such figures were applied.

In an effort to determine whether or not a basic formula could be worked out as applicable to any radiological department of any general hospital, a rather intensive study was made. Everything obtainable which was related to the economics of the practice of radiology was collected, analyzed, indexed, and filed. Departmental annual reports showing the number and types of examinations, technicians employed, film and chemical consumption, fee schedules, and, if possible, a floor plan of the department was solicited. A tremendous amount of information was gleaned at radiological meetings through personal conversation with radiologists, film and equipment manufacturers' representatives, and by visits to various departments in different parts of the country. Eventually sufficient material was obtained from these sources to enable us to work out out a formula and then, in order to test its accuracy, it was applied to places which had not been included in the study. The formula can be summed up as follows:

One radiologist can be expected to handle approximately 6,000 separate patients per year depending upon the type of examinations and the number of therapy cases. The figures are intended to apply to general roentgenography, as it is obvious that in those institutions where the work is predominantly of a special type, such as chest roentgenography, the case load could be much higher. Departments connected with a teaching institution require more medical personnel than the non-teaching departments. Other observers have arrived at similar figures and agree that this is about the correct number to insure careful examination, direction of technical procedures, calculation of dosages to be administered, supervision of therapy, study and consultation, interpretation of films, and other details attendant on the proper care of the patient and the departmental administrative duties. On the average, 16.2 per cent of the patients seen in a department of a general hospital or a private office are radiation therapy cases and these may be divided roughly into 80 per cent deep and 20 per cent superficial therapy. In efficient and well organized departments, we have found that the average case load is 5.6 patients per person personnel per day. The personnel to be considered includes all assistants such as technicians, orderlies, clerks, secretaries, and all lay employees, as well as radiologists and residents. Student technicians, first year residents, interns and part time employees may be counted as one-half of one person. It was found that average film consumption was 2.5 films per examination and that 16.6 roentgenographic patients produce twenty separate examinations. The cost of the 2.5 films was found to be $1.00 or when all sizes of films are used, the over-all average film cost is $0.40 per film. The equipment in the adequately equipped places amounted in value to approximately $1,000.00 per patient per day, *viz.*, $22,000.00 investment in equipment for 22 patients per day or $50,000.00 for 50 patients per day.

The average revenue per examination varied according to geographic location and per capita income but was usually between $7.00 and $8.00. The gross income derived from radiological services in a community was in no instance less than $1.00 per person population per year.

Each individual patient having a roentgen examination or a treatment consumes a portion of the working time of one or more persons in a department of radiology. Usually several persons are involved in

serving the patient. The accumulated personnel time consumed is fairly constant for radiation therapy patients. A greater number of persons enter into the total time consumed by roentgenographic patients in a large department but the same amount of time is used by fewer persons in a small department. It was found that the time spent in positioning, filming, processing, and filing was fairly uniform in each place where the personnel and equipment were adequate. The time involved in transportation of patients to and from the radiological department could also be accounted for in time but such transportation in many cases did not involve anyone connected with the department. Many departments maintain their own orderly service and, in such instances, the time spent in transporting patients is a departmental expense. Probably the greatest variables in time consumed per examination or per patient involved the length of the reports, reading, and typing time, and the lack of or the intricacy of the indexing and filing system. In a separate but not a comprehensive study of the time spent and the cost of reporting cases, it was found that the lengthy, involved descriptions requiring much transcribing time very rarely arrived at any definite conclusion while the short, concise reports made in the same department gave a definite opinion with very little discussion.

There has been a definite trend since the end of World War II for full time rather than part time radiological service even in the medium-sized hospitals. This is partly due to the fact that there are more radiologists available and also the increase in the volume of work in many hospitals has made it necessary to have a full time radiological consultant in the department. During this time, there has been a decrease in the number of salaried radiologists and a like decline in the number of radiologists without a hospital connection. No accurate figures can be obtained to show the number of radiologists who have entered into the private practice of radiology within the past five years. Probably those whose original intention was to open an office did not register with the Professional Bureau, but of the 958 radiologists registered with the Bureau from 1945 to 1950, only 56 records have been closed with the notation "Opened a private office."

The survey conducted by Cahal and Nyberg[10] of the American College of Radiology for the Council on Medical Service of the American Medical Association and published in 1947 revealed the multiplicity of financial arrangements between radiologists and hospitals and gave some of the reasons for the wide variations. The same general pattern of arrangements still exists but only a few of the general hospitals, with the exception of tax supported and teaching institutions, offer a salary as an inducement when seeking a radiologist. Group medical clinics practically always offer a salary. Virtually all requests from hospitals to the Bureau for a radiologist offer a financial arrangement on a percentage basis. Many hospital administrators who once advocated using the department of radiology as a source of income for non-supporting departments and the selection of a radiologist on a price basis only, now recognize the fact that sacrificing quality for low costs and added income to the hospital is not the best policy.

The Brodsky formula[8] was presumably a plan devised to compensate part time radiologists and pathologists for the time they spent in a department. The plan was never adopted except in a few instances, as far as we can learn. However, many modifications have been brought to our attention. The original plan entailed a rather complicated accounting system which finally resolved itself into an hourly wage scale. The income-sharing percentage of this reimbursement formula was to be applied only after the radiologist and the hospital had received their annual guaranteed income from the department and for that reason the arrangement has never been popular with radiologists.

General overhead expenses are always

present irrespective of the time spent in the department by the radiologist in the performance of either his medical or his administrative duties. In some of the large departments in the hospitals of this country, it seems quite apparent that many of the present difficulties and controversies now encountered because of a division of departmental administration between the hospital and the radiologist could be entirely eliminated by the appointment of a business manager. Such a person would fill a much needed gap in many institutions and thereby relieve the radiologist of responsibilities now entrusted to him and which detract from his teaching or consultation time.

As a general rule, in those institutions where good full time radiology is practiced with an adequate personnel to do the work, the general overhead has been found to vary from 50 to 55 per cent of the gross income (collections). From 40 to 45 per cent was found to be sufficient to provide adequate professional personnel. Even though the figures vary in different parts of the country according to the pay scale for non-professional assistants and the length of the work week, a general average showed that 55 per cent of the general overhead was used for salaries and expendable supplies. In other words, it required on the average $33.00 in salaries for non-professional personnel to use $22.00 in value paid out for films, chemical and other expendable supplies.

If a department of radiology is to be used to its best advantage for the benefit of the staff physicians, the patients and the community, then a sufficient amount of trained help must be employed, obsolete equipment discarded, and competently trained radiological consultants secured and retained. If such a course is followed, then only 10 per cent more or less of the revenue of the department can be set aside as profit or for a department fund. Exploitation of the radiologist by an institution or exploitation of an institution by a radiologist may be accomplished in many ways but neither can happen if the best interests of the department and of the patient are kept foremost.

The number of roentgen-ray machines owned and operated outside of institutions clincs, and the offices of radiologists is much greater than one would suppose. The distribution of such equipment is interesting. As would be expected, a large number of the installations are in the small towns where, because of public demand, one or more physicians purchased equipment. On the other hand, however, 50 per cent of such equipment is owned by physicians in cities of 50,000 or more population where 69 per cent of the radiologists are located.

Obviously, a large number of trained technicians are required to operate the roentgen-ray equipment in various hospitals, clinics, and radiologists' offices. The U. S. Department of Labor estimates that there are 20,000 trained roentgen technicians in this country and the American Registry of Technicians reports that 7,265 of these have been certified by the Registry. It can be assumed that there must be at least 10,000 additional partly trained persons for operation of the roentgen-ray machines in physicians' and specialists' offices. The decrease in employment of hospital technicians from 1945–1948, both full time and part time, cannot be explained and no recent figures are available to show whether there has been a continued decrease since that time. It has long been a recognized fact among radiologists that there has been a scarcity of well trained technicians and with the advent of the forty hour week and the steadily increasing volume of radiological work, the demand upon the 267 approved technician training schools is expected to be greater than ever before.

The frequency of roentgenographic examinations by conditions or anatomical parts of the body seems to be fairly uniform in all hospital departments. In some institutions, one or more services may be more active than others and this, of course, affects the amount of radiological work done

in that institution when compared with others. The type of industry predominant in an area will also affect the number of roentgenological examinations performed in that particular area. Highly industrial areas show a higher percentage of bone and joint examinations than agricultural areas, but in every section of the country chest studies average about one-third of all the examinations. This is verified by the fact that about 33 per cent of all payments for radiological benefits by Blue Shield Plans are for chest examinations and 50 per cent of all payments are for chest, gallbladder, and gastrointestinal tract examinations.

A study of a number of hospital annual reports shows that although the volume of work in the various radiological departments has increased tremendously over the years, the percentage of the various examinations by conditions has remained practically constant. The time-consuming special examinations requiring special equipment and, in many instances, separate rooms are only a fraction of 1 per cent of all examinations. These examinations are, on the whole and as they should be, confined to the large institutions where proper equipment has been installed and where an examining team can be trained for such procedures.

An increasing amount of the revenue in hospital radiological departments is now being derived from the prepayment Medical Care Plans (Blue Shield) of which there are 79 in operation with approximately 15,000,000 subscribers and a daily enrollment of about 28,000.[14] However, in some states radiological consultations are Blue Cross benefits and are paid for by the Hospital Care Plans. Much valuable statistical information pertaining to radiology is being accumulated by these plans. In a recent report[3] by 28 Blue Cross Plans, it was stated that in the first quarter of 1950 roentgen examinations cost the average Blue Cross patient $18.53, of which amount the plans paid on the average of $11.56. In a recent study[20] of the costs of acute hospitalized illnesses, 18.8 per cent of the hospitalized patients received radiological service at an average cost of $34.50 to each patient receiving the service. The average cost of $6.50 for radiology in all cases was 2.3 per cent of the total cost of the illness of the 1,796 patients included in the study.

Previously it has been stated in this paper that inquiries were made to the American College of Radiology about necessary space requirements for radiological departments when new departments were being built or old ones remodelled. The inquiries revealed the fact that both the radiologists and the hospital authorities were often very vague or lacking in accu-

TABLE I

POPULATION, PHYSICIAN,S MEDICAL SERVICES AND HOSPITAL CENSUS IN RELATIONSHIP TO CERTIFIED RADIOLOGISTS

150,000,000	Population in the United States (150,697,361)	
150,000	Practicing physicians (151,267)	73,079 general practice
1,000	Population per physician	55,049 specialists
201,277	Physicians in all categories in 1950 American Medical Association Directory	23,139 att. to spec.
		151,267
3,000	Certified radiologists in United States 1:50,000 population—1:50 physicians	
750,000,000	Medical services rendered annually	
5,000	Services per physician annually	
2,500,000	Medical services daily	
430,000	Hospital in-patients	
2,070,000	Office, clinic and home—daily	

TABLE II

RELATIONSHIP BETWEEN PHYSICIAN'S SERVICES, TOTAL PRACTICING RADIOLOGISTS AND EQUIPMENT OUTSIDE OF PHYSICIAN'S OFFICES

150,000	Physicians render 2,500,000 medical services daily
16	Services per physician per day
3,500	Radiologists and 600 residents—20 patients per day—82,000
610	Physician patient services per radiologist
20	Patients per radiologist per day—1:30
1:30	Refer to radiologist of 2,500,000 services equals 83,333
18,000	Roentgen-ray units—hospitals, radiologists, clinics
140	Physician patient service per roentgen-ray unit

TABLE III

NUMERICAL COMPARISON OF VARIOUS MEDICAL SPECIALTIES[2]

Physicians Who Limit Practice or Give Special Attention to Specialty of:	Total Number of Names
Group 1	
Obstetrics	2,438
Gynecology	1,203
Obstetrics and gynecology	6,798
Group 2	
Ophthalmology	3,143
Otology, laryngology, rhinology	2,602
Ophthalmology, otology, laryngology, rhinology	5,043
Group 3	
Neurology	173
Psychiatry	2,684
Psychiatry and neurology	2,726
Allergy	703
Anesthesia	2,204
Bacteriology	103
Cardiology	916
Clinical pathology	363
Dermatology	2,110
Gastroenterology	447
Hospital administration	358
Industrial practice	2,122
Internal medicine	12,079
Neurological surgery	393
Orthopedic surgery	2,532
Pathology	1,546
Pediatrics	6,321
Physical medicine	308
Plastic surgery	303
Proctology	916
Public health	1,669
Pulmonary diseases	1,830
Radiology and roentgenology	3,559
Surgery	19,976
Urology	2,896

TABLE IV

GENERAL HOSPITAL DATA—1949[7]

Number	4,761
Bed capacity	574,683
Bassinets	85,502
Patients admitted	15,450,311
Births	2,744,268
Average daily census	429,443
Patient days	156,746,695

TABLE V

HOSPITAL BEDS, ADMISSIONS AND ROENTGEN-RAY EQUIPMENT

4,761—General hospitals

2,257, 50 beds or less—77% have roentgen-ray equipment

991,	50 to 100 beds	All have roentgen-ray equipment
786,	100 to 200 beds	
357,	200 to 300 beds	
370,	300 or more beds	

15,000,000 Hospital admissions per year
50,000 Admissions daily
430,000 Hospital patient daily census
4,000 General hospitals diagnostic equipment
10,000 Diagnostic units 2.5 each
1 Unit per 5 daily admissions

TABLE VI

FULL TIME AND PART TIME PRACTICING RADIOLOGISTS

3,000	Radiologists full specialty or certified
500	Part specialty or non-certified
3,500	Full or part specialty service 4,000 hospital roentgen-ray departments
14.3	Hospital admissions per hospital radiologist per day

Table VII

ESTIMATED DAILY VOLUME OF RADIOLOGICAL PRACTICE BASED ON ANNUAL AVERAGE

7,200	Examinations and treatments per radiologist—306 days
23.5	Per radiologist per day
3,000	Radiologists, full specialty—certified
500	Radiologists, special interest—non-certified
600	Second and third year residents
4,100	Radiologists, assistants and residents—23.5 per day
96,350	Examinations and treatments per day
82,000	Patients—20 per radiologist per day
13,200	Treatments—16.2% of patients therapy
68,800	Roentgenographic patients
83,000	Examinations. 2.5 films each—207,500 films

Table X

PERCENTAGE DISTRIBUTION OF RADIOLOGISTS IN THE UNITED STATES[17]

City Size	Radiologists	Physicians
Under 5,000	3%	17.1%
5,000–25,000	16%	16.9%
25,000–50,000	12%	9.4%
50,000–100,000	12%	8.4%
Over 100,000	57%	48.2%
Geographic Area		
New England	8%	7.9%
Middle Atlantic	27%	28.4%
Central	32%	27.4%
South and Southwest	20%	21.9%
Mountain and Pacific	13%	14.4%

Table VIII

RADIOLOGISTS AND RADIOLOGICAL TRAINING[16]

Diplomates of the American Board of Radiology (Approx. 275 deceased—many retired, Canadian, etc.)		3,356
Departments Approved for Residency Training		
Three years in radiology	145	363
Three years in roentgenology	40	
Three years in diagnostic roentgenology	5	
Three years in therapeutic radiology	5	
Residents in training 1949		972
Applicants for American Board of Radiology examinations, average per year (not including re-examinations)		375–400

In addition to the above approvals for three year training there are many departments with limited approval.

Table IX

ORGANIZED RADIOLOGY—ONLY ACTIVE MEMBERS INCLUDED[9]

American College of Radiology	Members	1,750	(1,766)
	Fellows	600	(591)
American Roentgen Ray Society	Members	500	(503)
Radiological Society of North America	Members	2,150	(2,149)
Local, State and Regional Societies		76	
Diplomates American Board of Radiology (1950) (approximately 275 deceased)		3,356	

TABLE XI

RATIO OF RADIOLOGISTS TO POPULATION IN UNITED STATES

Year	Population	Radiologists	Population per Radiologist
1931	122,775,041	1,005	122,164
1938	128,877,000 (est.)	2,191	58,821
1950	150,697,361	3,559	42,342

rate information about the actual amount of work being done in a department. The location and allotted space for an "x-ray room" appeared in some instances to be an afterthought of hospital planning boards. An over-all picture of the situation obtained from letters of inquiry, published reports, and discussions with radiologists showed a hodgepodge of various opinions and almost a complete absence of any uniform background built up from the compiled experience of others.

Working under the assumption that the law of supply and demand had established the amount of space necessary for the operation of a radiological department under certain peak loads, measurements were obtained of a number of departments. Some of the figures were obtained from blueprints furnished to us, and some others were derived by measuring the actual space

TABLE XII

EAST OF MISSISSIPPI RIVER[1]

	Radiologists			Practicing Physicians				
	Full	Part	Total	General Practitioner	Specialist		Att. Spec.	Total
Maine	13	1	14	431	207	(60)	152	790
New Hampshire	15	2	17	294	189	(40)	122	605
Vermont	9	2	11	245	116	(48)	73	434
Massachusetts	113	18	131	3,042	2,360	(56)	909	6,311
Connecticut	57	6	63	1,011	1,148	(43)	292	2,451
Rhode Island	14	0	14	337	352	(57)	116	805
New York	444	89	533	9,900	10,166	(53)	3,681	23,747
Pennsylvania	236	48	284	5,221	4,061	(47)	1,805	11,087
New Jersey	95	28	123	2,452	1,913	(58)	1,192	5,557
Delaware	9	2	11	171	118	(35)	31	320
District of Columbia	25	2	27	631	789	(61)	106	1,526
Maryland	33	3	36	1,073	952	(68)	207	2,232
West Virginia	24	6	30	773	506	(62)	213	1,492
Virginia	47	10	57	1,297	726	(50)	279	2,302
North Carolina	45	5	50	1,321	866	(56)	312	2,499
South Carolina	14	5	19	714	302	(71)	186	1,202
Georgia	27	8	35	1,145	813	(84)	407	2,365
Florida	59	1	60	998	894	(37)	311	2,203
Alabama	20	6	26	982	510	(89)	290	1,782
Mississippi	11	1	12	801	251	(113)	188	1,240
Tennessee	33	6	39	1,223	806	(71)	333	2,362
Kentucky	25	6	31	1,235	631	(86)	286	2,152
Ohio	134	6	140	3,602	2,867	(57)	1,208	7,677
Indiana	55	16	71	1,923	1,010	(64)	610	3,543
Illinois	144	27	171	5,124	3,432	(71)	1,706	10,262
Michigan	103	13	116	2,380	2,107	(53)	856	5,343
Wisconsin	49	11	60	1,611	866	(61)	506	2,983
	1,853	328	2,181	49,937	38,858	(57)	16,377	105,272

The number of physicians per radiologist in each state is shown in parenthesis.

occupied in a number of departments and private offices in various parts of the country. In all cases the average and peak patient load was obtained, as well as the full time and part time personnel, the ratio of in-patients to out-patients, and other pertinent data that might be of help in determining the average required space per patient per day. Private office space, usually in a moderately high rent district, was usually much less space per patient per day than for a similar patient load in a hospital. Under actual working conditions, the average desirable space was 100 sq. ft. per patient per day and the minimum of space required was 50 sq. ft. per patient per day. These figures are wall-to-wall measurements and include all closets, corridors, dressing rooms and storage space. The 100 sq. ft. per patient per day will

TABLE XIII

WEST OF MISSISSIPPI RIVER[1]

	Radiologists			Practicing Physicians				
	Full	Part	Total	General Practitioner	Specialist		Att. Spec.	Total
Minnesota	52	7	59	1,452	958	(53)	348	2,758
Iowa	36	9	45	1,277	610	(64)	441	2,328
Missouri	38	9	47	1,816	1,455	(100)	544	3,815
Arkansas	14	3	17	897	263	(98)	212	1,372
Louisiana	39	3	42	1,030	731	(51)	244	2,005
North Dakota	4	0	4	209	132	(100)	70	411
South Dakota	6	1	7	243	96	(73)	102	441
Nebraska	19	5	24	734	394	(69)	185	1,313
Kansas	19	10	29	837	450	(84)	319	1,606
Oklahoma	14	3	17	956	541	(130)	329	1,826
Texas	112	19	131	3,213	2,155	(57)	1,059	6,426
Montana	11	0	11	272	157	(47)	83	512
Wyoming	3	0	3	132	34	(70)	51	217
Colorado	36	5	41	713	637	(45)	263	1,613
New Mexico	7	1	8	201	130	(44)	76	307
Idaho	5	0	5	270	95	(87)	71	436
Utah	13	1	14	299	222	(48)	102	624
Arizona	19	2	21	242	291	(34)	119	652
Washington	38	5	43	1,031	805	(57)	335	2,171
Oregon	31	2	33	738	512	(45)	138	1,388
Nevada	4	1	5	86	56	(42)	26	168
California	268	15	283	5,965	5,209	(47)	1,545	12,719
	788	101	889	22,613	15,933	(57)	6,662	45,208

Number of physicians per radiologist in each state is shown in parenthesis.

TABLE XIV

SUMMARY OF DISTRIBUTION OF PHYSICIANS AND RADIOLOGISTS

	Radiologists				Physicians			
	Full Specialists	Att. to Spec.	Total	General Practitioner	Full Specialists		Att. to Spec.	Total
East	1,853	328	2,181	49,937	38,858	(57)	16,377	105,172
West	788	101	889	22,613	15,933	(57)	6,662	45,208

TABLE XV

BED CAPACITY—FULL TIME AND PART TIME RADIOLOGIST[12]

Bed Capacity	Radiologist	
	Full Time	Part Time
1– 99	21	286
100–249	54	456
250–399	34	141
400–749	38	77
750 and over	13	51
	160	1,011

Radiological service to various size hospitals in 1940; 50 per cent of all radiologists in United States represented.

TABLE XVI

NUMBER OF QUESTIONNAIRES RETURNED

	Number	Percentage
Total membership American College of Radiology, 1946..	1,820	100
Questionnaires returned.....	886	49
Radiologists who did not reply.	934	51
Questionnaires Used		
Total questionnaires returned..	886	
No information or radiologist retired.....	6	
Replies from radiologists on active duty with Army, Navy, Public Health Service, or Veterans Administration....	30	
Questionnaires used.....	850	

TABLE XVII

DISTRIBUTION OF RADIOLOGISTS ACCORDING TO THOSE WITH FULL TIME PRIVATE OFFICE PRACTICE AND THOSE WITH FULL OR PART TIME PRACTICE IN HOSPITALS

	Number	Percentage
Radiologists with full time office practice (no hospital practice)..	146	17
Radiologists who are directors of a hospital radiological department	582	69
Associates of directors of hospital radiological departments.....	122	14
Total.....	850	100

allow for the cystoscopic room in the department of radiology and for expansion of facilities by addition of accessory equipment only.

Some of the suggested plans examined made no allowance for therapy in institutions of less than 100 beds. When therapy was added to the 200 bed hospital plans, more space was devoted to this 16.2 per cent of the patient load than had originally been planned for the roentgenographic work.

The personnel for a department, as shown in the staffing guides studied, seemed to be based entirely upon the needs according to the hospital bed capacity,[18] without any consideration or anticipation of outpatient work for the department of radiology.

The lack of such information has led to the appointment of a committee within the American College of Radiology, which

TABLE XVIII

RADIOLOGISTS IN HOSPITAL RADIOLOGICAL DEPARTMENTS[10]

Full Time or Part Time	Number	Percentage
Full time in 1 hospital.....	250	35
Part time in 1 or more hospitals...	454	65
Total.....	704	100
Number of Hospitals		
Radiologists who practice in 1 hospital.....	370	53
Radiologists who practice in 2 hospitals.....	183	26
Radiologists who practice in 3 hospitals.....	95	13
Radiologists who practice in 4 or more hospitals.....	56	8
Total.....	704	100
Number of Radiologists Who Practice in an Office in Addition to Hospital Practice		
Radiologists with office practice as well as hospital practice.....	420	60
Radiologists with no office practice	269	38
Did not indicate.....	15	2
Total.....	704	100

TABLE XIX

DISTRIBUTION ACCORDING TO PERCENTAGE OF GROSS OR NET RECEIPTS[10]

(Not All Radiologists Reported a Figure)

Percentage Division of Gross Receipts			Percentage Division of Net Receipts		
Amount	Radiologists Reporting		Amount	Radiologists Reporting	
	Number	Percentage		Number	Percentage
10 to 25%	22	8	10 to 25%	2	4
30 to 35%	54	21	30 to 35%	4	7
40 to 45%	50	20	40 to 45%	7	13
50 to 55%	120	47	50 to 55%	27	51
60 to 65%	10	4	60 to 65%	8	15
70 to 75%	0	0	70 to 75%	5	10
Totals	256	100	Totals	53	100

TABLE XX

DISTRIBUTION ACCORDING TO SALARY PLUS PERCENTAGE OF GROSS OR NET RECEIPTS[10]

Salary Plus Percentage of Gross Receipts			Salary Plus Percentage of Net Receipts		
Amount	Radiologists Reporting		Amount	Radiologists Reporting	
	Number	Percentage		Number	Percentage
10 to 25%	9	30	10 to 25%	4	15
30 to 35%	7	20	30 to 35%	4	15
40 to 45%	7	20	40 to 45%	8	30
50 to 55%	9	30	50 to 55%	11	40
Totals	32	100	Totals	27	100

committee is now working with the architectural divisions of the manufacturers of roentgen-ray equipment and of films, and with the American Institute of Architects, in the preparation of a manual setting forth suggested standards for planning radiological departments having an actual or predicted daily patient load. It is now considered essential that a serious study be made of all possible sources of patients for both diagnosis and therapy and that the planning be executed before the department is built, rather than after it has been in operation.

In two previous economic surveys[10,12]

TABLE XXI

DISTRIBUTION ACCORDING TO RATIO OF NET TO GROSS INCOME FOR INDEPENDENT PRACTITIONERS IN HOSPITALS

(Not All Reported Total Gross and Net Income)

Amount	Radiologists Reporting	
	Number	Percentage
30 to 40%	5	10
45 to 55%	28	56
60 to 65%	14	28
70 to 80%	3	6
Totals	50	100

it was determined that the majority of radiologists practiced alone. In 1939 it was shown that 18 per cent of the radiologists reported a partnership, but in 1947 this had increased to 22 per cent who reported that they had a partnership with one or more radiologists. The greatest number of such associations have been found to be in those instances where a private office is operated either with or without hospital connections. Group practice of radiology has been found to be a far more frequent form of association in the Middle West than it is in other parts of the country. The individual hospital radiologist, even though not salaried, is considered a hospital employee if he receives remuneration direct from the hospital. Only a small percentage of these radiologists own any of the equipment in the hospital, buy any of the supplies or pay any of the technical or clerical help. However, the associates and assistants in a hospital department are paid, in the majority of instances, by the radiologist and not by the hospital.

In the previous studies conducted by the American College of Radiology, as well as a more recent one in conjunction with the Brookings Institution, it has been quite evident that the question is not how much

TABLE XXII

DISTRIBUTION OF RADIOLOGISTS WHO PRACTICE IN HOSPITALS;[10] ACCORDING TO OTHER FACTORS

(Totals in Each Instance Vary with the Number Reporting that Item)

	Radiologists Reporting	
	Number	Percentage
1. Radiologists who pay associates..	92	13
Radiologists who do not pay associates or have no associates in the hospital.....	594	87
Totals.....	686	100
2. Radiologists who own all the roentgen-ray equipment in hospital.....	36	5
Radiologists who own part of the roentgen-ray equipment in hospital.....	30	4
Radiologists who own no roentgen-ray equipment in hospital.	630	91
Totals.....	696	100
3. Fees collected by radiologists....	115	16
Fees collected by hospital.....	595	84
Totals.....	710	100
4. Technicians paid by radiologists.	76	10
Technicians paid by hospital....	634	90
Totals.....	710	100

TABLE XXIII

HOSPITAL EMPLOYEES—INDEPENDENT PRACTITIONERS

86%	Of radiologists practicing in hospitals—employee
14%	Independent practitioners in hospitals
70%	Of all radiologists are employees of hospitals
30%	Independent practitioners in a hospital or office
37%	Hospital radiologists salaried employees in 1939
32%	Salaried employees in 1946
21%	Of radiologists reported office practice only in 1939
17%	Reported no hospital connection in 1946; 4% decrease
83%	Practice to some extent in a hospital roentgen-ray department

All radiologists receiving direct direct remuneration from hospitals are designated as employees irrespective of the method of division of fees.

TABLE XXIV

OWNERSHIP OF MEDICAL ROENTGEN-RAY EQUIPMENT[17]

Diagnostic and therapeutic installations in United States hospitals		
Diagnostic		5,170
Therapeutic (duplicated)	1,850	
Roentgen-ray installations owned by private physicians (under 65 years of age) in the United States		32,250
Total medical roentgen-ray installations		37,420

medical radiological service is being rendered to the public but that the most important factor is the type and quality of the service.

No comment has been made about variations in fee schedules in various parts of the country, the growth of mass surveys or some of the other phases of the practice of radiology. Discussions of these were not considered necessary to carry out the original intention of this report which has been to show the extent of the practice of radiology in the United States—how and by whom it is done.

A number of tables accompany this discussion in order to better illustrate statistical information and comparative figures not included in the paper.

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(*Additional references on pp. 945 and 946*)

Table XXV

ESTIMATED DISTRIBUTION OF PHYSICIANS IN THE UNITED STATES OWNING THEIR OWN ROENTGEN-RAY UNITS BY TYPE OF PRACTICE[17]

Type of Practice	Total Physicians	Estimated Number Owning Roentgen-Ray Equipment	Percentage of Total Physicians Owning Roentgen-Ray Equipment
General practitioners	73,079	19,680	61.0
General surgery	19,976	3,000	9.3
Internal medicine	12,079	2,200	6.8
Radiology	3,559	1,300	4.0
Eye, ear, nose, throat	10,788	1,090	3.4
Dermatology	2,110	1,050	3.3
Industrial medicine	2,122	840	2.6
Orthopedic surgery	2,532	810	2.5
Pediatrics	6,321	750	2.3
Urology	2,869	700	2.2
Cardiology	916	290	0.9
Gastroenterology and tuberculosis	2,277	200	0.6
Obstetrics and gynecology	6,798	180	0.6
Allergy	703	160	0.5

Table XXVI

ESTIMATED DISTRIBUTION OF PHYSICIANS OWNING ROENTGEN-RAY EQUIPMENT[17]

By City Size

City Size	General Practice	Specialist	Total
Under 5,000	6,490	—	6,490
5,000– 25,000	4,530	1,890	6,420
25,000– 50,000	980	2,150	3,130
50,000–100,000	1,770	1,740	3,510
Over 100,000	5,910	6,790	12,700
Total	19,680	12,570	32,250

By Geographic Area

Geographic Area	General Practice	Specialist	Total
New England	1,260	920	2,180
Middle Atlantic	5,150	4,230	9,380
Central	6,200	2,610	8,810
South and Southwest	4,310	2,620	6,930
Mountain and Pacific	2,760	2,190	4,950
Total	19,680	12,570	32,250

Approximately 20 per cent of roentgen-ray equipment is owned in cities under 5,000 where 3 per cent of the radiologists are located and approximately 40 per cent where 57 per cent of the radiologists practice.

TABLE XXVII

ROENTGEN-RAY EQUIPMENT INSTALLATIONS

19,600	General practitioners
1,300	Radiologists
12,000	Specialists
1,000	Clinics and other groups
5,200	Hospitals (non-governmental)
39,000	(1,800 therapy duplicated)

Roentgen-Ray Equipment Units		
20,000	General practitioners	1 unit each
3,000	Radiologists	2.5 units each
12,000	Specialists	1 unit each
2,000	Clinics	2 units each
13,000	Hospitals	3 units each
50,000	(1,800 therapy duplicated)	

1 roentgen-ray unit per 3,000 population.

TABLE XXVIII

ESTIMATED VALUATION AND DEPRECIATION OF ROENTGEN-RAY EQUIPMENT IN THE UNITED STATES

50,000	Roentgen-ray units in hospitals, offices, clinics
$4,000	Average investment equipment, accesories, etc.
$200,000,000	Initial cost of roentgen-ray equipment in United States
$30,000,000	Annual depreciation at 15%
$0.20	Per person population in United States per year

TABLE XXIX

ROENTGEN-RAY TECHNICIANS

20,000	Roentgen-ray technicians in the United States (U. S. Dept. of Labor)
10,000	Partially trained technicians (estimated)
7,265	Registered technicians (September, 1950, Registry report)

Hospital Employment of Technicians

Year	Full Time	Part Time
1941	5,534	1,535
1945	7,996	1,660
1948	7,116	1,604

Note decrease in number of employed hospital technicians 1945–1948.

TABLE XXX

COMPARATIVE DISTRIBUTION OF ROENTGEN-RAY EXAMINATIONS

Roentgenographic examinations	(30,355)	51.88%
Photofluorograms	(19,677)	33.64%
Roentgenoscopic examinations	(8,465)	14.48%
Total patients	58,497	100.00%

University of Minnesota Hospitals.

TABLE XXXI

ROENTGRAPHIC EXAMINATIONS BY CONDITIONS

	Per Cent
Chest	33.01
Stomach, duodenum, esophagus	12.22
Abdomen	6.47
Spine	6.34
Colon	5.66
Skull orbits, sella turcica	4.42
Pelvis and hip joints	4.16
Thigh, leg, knee	3.17
Urographic excretion	2.82
Urinary tract	2.60
Heart	2.08
Gallbladder	1.98
Ankle and foot	1.85
Sinuses, paranasal and mastoids	1.80
Wrist and hand	1.58
Arm, forearm, elbow	1.38
Urographic, retrograde	1.32
Sacroiliac	1.27
Shoulder girdle	1.15
Facial bones	0.77
Cholangiogram	0.59
Ribs and sternum	0.58
Bronchogram	0.48
Ventriculogram	0.47
Small intestine	0.44
Encephalogram	0.38
Miscellaneous	1.00
Total number of examinations 30,355	100.00

1947–1948 University of Minnesota Hospitals.

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Table XXXII

DISTRIBUTION OF ROENTGEN-RAY USE[17]

Roentgenographic examinations	(30,355)	43.5%
Photofluorograms	(19,667)	28.2%
Roentgenoscopy	(8,465)	12.1%
Therapy	(11,465)	16.2%
Total Patients	69,952	100.0%
Comparative Distribution of Roentgen Therapy		
Deep therapy, 200, 220, and 400 kv. (peak)	(9,063)	79.0%
Superficial therapy, 100–140 kv. (peak)	(2,299)	20.2%
Contact therapy	(103)	.8%
Total number therapy patients	11,465	100.0%

University of Minnesota Hospitals.

Table XXXIII

ANATOMICAL DISTRIBUTION OF EXAMINATIONS IN BOTH TEACHING AND NON-TEACHING HOSPITALS

	A (17,000)	B (17,000)	C (25,000)	D (30,000)	E (41,000)	F (350,000)
Head	1,431	1,108	2,106	2,435	3,686	34,372
Bone and joint	4,406	6,843	8,731	6,385	11,829	114,349
Gastrointestinal, gall bladder	4,234	3,428	2,180	8,192	6,528	57,820
Genitourinary	1,455	735	1,730	2,132	2,270	18,277
Chest	5,604	5,239	9,437	10,908	10,378	115,137

A. Grace Hospital, Detroit, Michigan, 1945[4]
B. St. Joseph Mercy Hospital, Ann Arbor, Michigan, 1948[6]
C. Kern County Hospital, Bakersfield, California, 1949.[5]
D. University of Minnesota Hospitals, Minneapolis, Minnesota, 1947.[17]
E. University of Michigan Hospital, Ann Arbor, Michigan, 1941.[15]
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Table XXXIV

PERSONNEL EQUIPMENT PATIENT RATIO FORMULA[11]

6,000	Patients per radiologist per year—19.6 (20 per day)
16.6	Patients produce 20 examinations
16.2%	Therapy patients or 3.25 therapy per 20 patients
23.5	Examinations and treatments per radiologist per day
7,200	Examinations and treatments per radiologist per year
5.6	Patients per person personnel per day
100	Sq. ft. per patient per day desirable, 50 sq. ft. minimum
$1,000	Minimum investment equipment per patient per day
2.5	Films per examination. $1.00 film and $0.07 chemical cost
$1.00	Per person community population for roentgen ray per year
$7.00–8.00	Average revenue per examination. Bad debts, free work, adjustments, etc. Formula applicable to general non-teaching hospitals and offices. Efficiency dependent upon layout of department and types of patients.

TABLE XXXV

ACCUMULATED PERSONNEL TIME PER PATIENT

5.6	Patients per person personnel per day
10	Personnel—56 patients (2 radiologists; 4 technicians; 1 dark room; 1 secretary registration clerk; 1 orderly; 1 typist)
56	Patients—9 therapy (16.2%) 47 roentgenographic or 56 examinations (16.6 patients 20 examinations; 20 in 36 out-patients)
65	Total examinations and treatments

Procedure	Time Required Minutes
Registration, appointments, collecting, etc.	6
Checking required, wet films, therapy	7
Positioning, filming, treatment	12
Processing, marking, filing: 4 min. per film (2.5 per exam.)	10
Roentgenoscopy, interpretation, consultation dosage	12
Typing, indexing, record keeping, filing	7
Transportation—in-patients only	6
Accounting, insurance, billing, etc.	12
Total accumulated time per patient	72
Clerical—Registration, accounting, record keeping	25
Technical—Filming, processing, therapy, film storage	22
Medical—Roentgenoscopy, interpretation, consultation, therapy supervision	19

TABLE XXXVI

AVERAGE OPERATION EXPENSE OF DEPARTMENT OF RADIOLOGY IN BOTH LARGE AND SMALL HOSPITALS

50–55%	Gross income (collections) general overhead
40–45%	Collections for professional personnel
50–55%	Of general overhead—salaries, films, chemicals
33%	Salaries—non-professional personnel
22%	Films and chemicals
45–50%	Of general overhead—fixed charges and other supplies
5–10%	Department fund

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ROENTGEN TREATMENT OF CERVICAL SPONDYLOSIS*

A FOLLOW-UP EXAMINATION OF 625 PATIENTS

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OSLO, NORWAY

CERVICAL spondylosis is here defined as the aggregate of the degenerative wear and tear phenomena which frequently occur with increasing years in the middle and lower part of the cervical spine—together with its associated symptoms

Anatomicopathologically cervical spondylosis includes (1) lesions of the intervertebral disc and associated bone reaction, *i.e.*, osteochondrosis, (2) exostotic formations such as lipping and spiculation, *i.e.*, spondylosis in the narrower sense of the word, and (3) deforming arthrosis of the small intervertebral joints.

The intervertebral foramina and the vertebral canal may be narrowed, partly by osteophytes, partly by disc protrusion or herniation of the nucleus pulposus. Both are regarded as attributable to the same disease of which the disc lesion is the primary cause. This may result in compression of the spinal nerve roots, of the vertebral artery, vein and vertebral plexus of sympathetic nerves, respectively. An associated perineuritis with edema may aggravate the symptoms which are stiffness and pain in the neck radiating to the occiput, shoulder and arm with paresthesia of the fingers, and some less constant features.

Monotonous and unbalanced work, particularly with pull on the arms and spastic fixation of the shoulder girdle may be considered as exciting causes. Anything that may interfere with the physiological stretching of the nerve plexus must be considered an etiological factor, *viz.*, spondylosis with exostosis and protrusion of a disc, associated inflammatory phenomena, scalenus anticus syndrome, or muscular spasm.

The diagnosis is suspected from the symptoms and should be verified by roentgenographic examination.

It is an established fact that roentgen treatment may alleviate pain resulting from arthrosis and spondylosis. The method of treatment has been used on an increasing scale during the past twenty-five years in this country. The importance of these diseases regarding efficiency of work, from reduced joy of work to loss of working hours and disability, is being given an ever increasing attention. Considerable sums have been and are being invested in treatment for arthrosis and spondylosis. Thus, it is of essential importance to clarify whether or not roentgen treatment can be considered a useful method in the treatment of these diseases.

As regards roentgen treatment of cervical spondylosis, no representative series have appeared to my knowledge. It is rather surprising how little attention is being paid to this method of treatment in the Anglo-American literature. It seems that more stress has been placed on the mechanical etiological factors, and the treatment suggested has been mainly directed towards reducing the strain by mechanical means (traction, collars, etc.) or, in some instances, neurosurgery.

The paper presented by von Pannewitz[4] in 1933, "Die Röntgentherapie der Arthritis deformans" comprises no less than 1,507 cases. However, most of these cases were arthrosis confined to the joints of the extremities. The series thus merely includes 223 cases of spondylosis, among which there were only 24 cases of cervical spondylosis. The excellent results presented by von Pannewitz for the total material cannot therefore be considered conclusive regard-

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TABLE I

ROENTGEN TREATMENT OF CERVICAL SPONDYLOSIS

Patients treated during the two year period 1945–1947
Observation period: Maximum 3 years, minimum 1 year

Total number of patients treated—first time—			980
Dead	15		
Not traceable	24		
No response	315 (32%)		354
Contacted			626
Re-examined at the hospital		412	
Questionnaire	214–1*	213	
Actual series		625 (64%)	

* Unfit for use.

ing the effect of roentgen treatment in cervical spondylosis.

Forsberg[2] presented at the congress of neurologists in Stockholm in 1938 a series of 72 patients.

Brinch,[1] in 1944, reported the results in 164 patients.

In our department, Dr. A. Holtermann has paid special attention to this disease, and a great number of patients have during recent years been treated with roentgen irradiation. We have had the impression, during our work with these patients, that the treatment has been of great aid in most cases, though recidivation evidently occurred sooner or later in many instances. In order to give a numerical presentation of the results, we have followed up all patients treated during a two year period.

We wrote to all these 980 patients and asked them to report at the hospital for re-examination or to fill out an enclosed questionnaire. Fifteen were dead, 24 could not be traced, and 315 did not reply (Table 1).

The answers received were compared with the therapy charts. The group re-examined at the hospital and the group re-examined by means of questionnaires were considered separately. However, as similar results were obtained regarding all essential points, both groups were later considered as a whole.

In order to check the group which did not respond to our appeal, patients whose names started with A and B, *viz.*, about 25 patients, were contacted over the telephone. In this manner we obtained about 100 per cent response from these patients. As the information received in this manner

TABLE II

DISTRIBUTION ACCORDING TO AGE AND SEX

Group	Total		Men		Women		Housewives	
	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
1. <20 yr.	0	—	0	—	0	—	0	—
2. 20–29 yr.	16	3	2	1	14	3	5	2
3. 30–39 yr.	56	9	15	10	41	9	31	9
4. 40–49 yr.	188	30	42	28	146	31	96	28
5. 50–59 yr.	202	32	45	30	157	33	123	35
6. 60–69 yr.	127	20	33	22	94	20	78	22
7. >70 yr.	36	6	14	9	22	4	15	4
	625		151		474		348	
			24%		76%		73%	
Bentzen	117		46		71		37	
			40%		60%		53%	
Brinch	164		36%		64%			

Table III

RESULTS

	No.	Per Cent	Women		Men	
			No.	Per Cent	No.	Per Cent
1. Complete relief	187	30 (29.92)	130	27	57	38
2. Considerable relief	251	40 (40.16)	194	41	57	38
3. Improvement	126	20 (20.16)	96	20	30	20
4. No improvement	61	10 (9.76)	54	11	7	4
	625		474		151	

	215 von Pannewitz Per Cent	164 Brinch Per Cent	72 Forsberg Per Cent	625 Lundar Per Cent
1.	24	18	29	30
2.	30	49	33	40
3.	22	21	27	20
4.	24	12	11	10

did not deviate from that otherwise obtained, we believe that the 625 patients who were re-examined constitute a representative portion of the entire series.

None of the patients were under the age of twenty, and more than half of the patients were aged forty to sixty years (Table II). The distribution according to age was fairly the same for men and women. There were 76 per cent women of which 73 per cent were housewives. This preponderance of women and housewives is probably mainly or entirely related to the fact that our hospital is situated in a residential district. However, there is a definite preponderance of women and housewives also in other series, *e.g.*, in that published by Brinch, Denmark, and among 117 patients treated during 1948 at Dr. Bentzen's Institute which is in the center of the city of Oslo.

The results (Table III) are divided into four groups according to von Pannewitz. For a comparison the results obtained by von Pannewitz (columna totalis) and those obtained by Brinch, whose series were treated with a somewhat different technique, and those in Forsberg's series, are given.

In 70 per cent in the present series excellent results were obtained, and 90 per cent were benefited by the treatment.

Table IV

RESULTS IN RELATION TO AGE

	2 20–29		3 30–39		4 40–49		5 50–59		6 60–69		7 >70		Total	
	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
1.	4	25	11	19	61	33	55	27	50	39	6	17	187	30
2.	5	31	29	52	68	36	85	42	47	37	17	47	251	40
3.	5	31	10	18	40	21	40	20	21	17	10	28	126	20
4.	2	13	6	11	19	10	22	11	9	7	3	8	61	10
	16		56		188		202		127		36		625	

TABLE V

INCIDENCE OF RECURRENCE

Number of cases	625
No improvement	61
Improvement	564
Recurrence	248 (44%)
No recurrence	316 (56%)

Time of Recurrence

	No.	Per cent
1. <2 mo.	2	1
2. 2–6 mo.	32	13
3. 6–12 mo.	76	30
4. 1–3 yr.	138	56
	248	

Relation to Improvement

		Recurrence	
1. Complete relief	187	87	47%
2. Considerable relief	251	108	43%
3. Improvement	126	53	42%
	564	248	

The results obtained for the various age groups (Table IV) were fairly the same, though particularly good results were obtained for the 127 patients in the sixty year group.

In about 50 per cent of those patients showing relapse, it did not occur until after one year or more (Table V). It is only in the group where complete relief was achieved that recurrence can be definitely ascertained. The recurrence is usually moderate and responds to repeated treatment.

About 50 per cent of the patients had had their symptoms for more than two years before roentgen treatment was started (Table VI). The results are better, the earlier the treatment is instituted, though considereation must be given to the tendency to spontaneous improvement. However, excellent results were also obtained in the 316 patients who had had symptoms for more than two years.

The incidence of recurrence is higher, the longer the duration of symptoms (Table

TABLE VI

DURATION OF SYMPTOMS

	No.	Per cent
1. <2 mo.	65	10
2. 2–6 mo.	105	17
3. ½–2 yr.	139	22
4. >2 yr.	316	51
	625	

Duration of Symptoms in Relation to the Results

Results:			1 <2 mo.		2 2–6 mo.		3 ½–2 yr.		4 >2 yr.	
	Total	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
1.	187	30	39	60	40	38	42	30	66	21
2.	251	40	19	29	37	35	64	46	131	41
3.	126	20	5	8	21	20	23	17	77	25
4.	61	10	2	3	7	7	10	7	42	13
	625		65		105		139		316	

Table VII

RECURRENCE IN RELATION TO DURATION OF SYMPTOMS

Recurrence:	1 <2 mo.	2 2–6 mo.	3 ½–2 yr.	4 >2 yr.	Total
1. <2 mo.	0	0	2	0	2
2. 2–6 mo.	2	5	7	18	32
3. 6–12 mo.	7	9	14	46	76
4. 1–3 yr.	8	22	33	75	138
	17	36	56	139	248
of:	63	98	129	274	564
%	27	37	43	50	44

vii). Thus, not only are better results obtained, but relief will persist longer, the earlier the treatment is instituted.

Roentgenograms of the cervical column (Table viii) were available for 408 patients who were confined to 5 various groups according to our classification as shown below. (Fig. 1, *A* and *B*, 2, 3, 4, *A* and *B*, 5, *A* and *B*).

Normal conditions were found in 2 patients only. An entirely normal cervical spine is an exceptional finding in healthy adult subjects. Definite disc lesions were present in 61 per cent of the patients. However, the reults, like the symptoms, bear very little relation to the roentgenographic findings. Considerable relief was obtained in 76 per cent in group 1, in 76 per cent in group 2, in 71 per cent in group 3, and in 69 per cent in group 4.

The incidence as well as the severity of the roentgenopraphic changes increases with increasing age (Table ix).

Treatment (Table x) consists of six applications of 125 r through a posterocervical field over a period of four weeks (1st, 4th,

Table VIII

ROENTGENOGRAPHIC CHANGES

Group:	No.	Per cent
0.	2	0.5
1.	71	17.5
2.	87	21.0
3.	123	30.0
4.	125	31.0
	408	65.0
	217	35.0
	625	

in Relation to Results

	Total		0		1		2		3		4	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
1.	187	30	1	50	27	38	28	32	36	30	39	31
2.	251	40	0	—	27	38	38	44	51	41	48	38
3.	126	20	0	—	10	14	12	14	28	23	21	17
4.	61	10	1	50	7	10	9	10	8	6	17	14
	625		2		71		87		123		125	

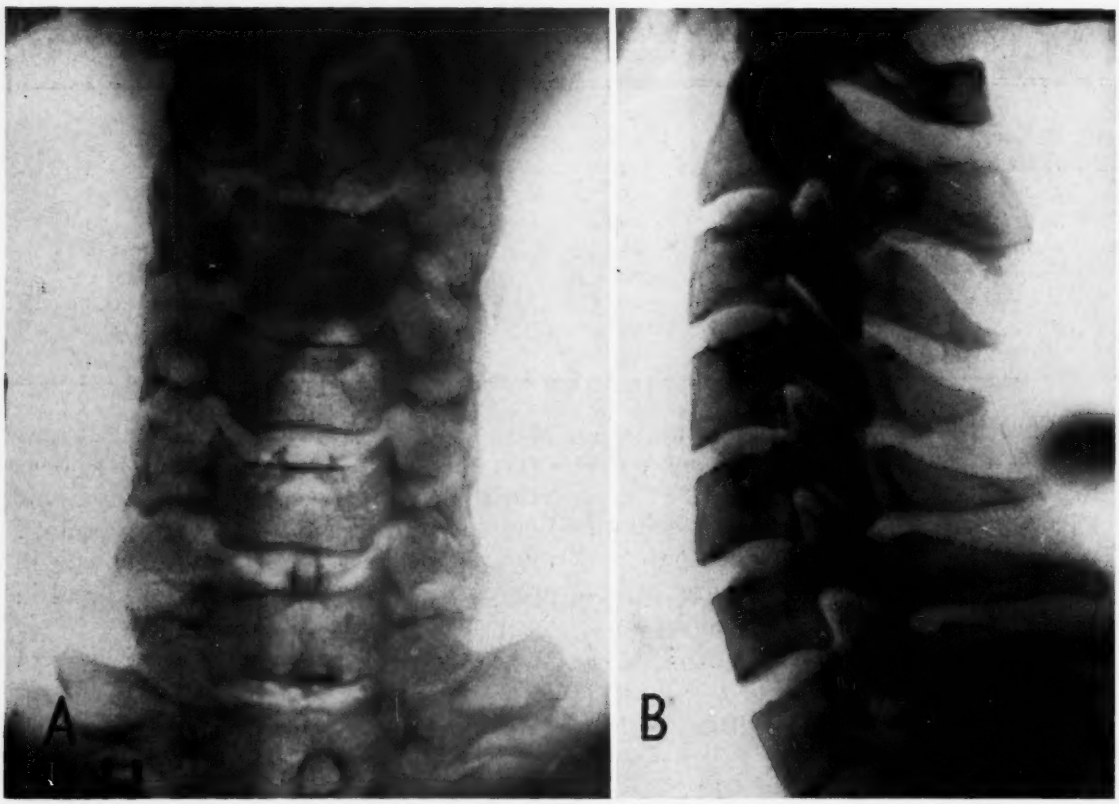

Fig. 1, (*A*) and (*B*) Group 0: Normal conditions

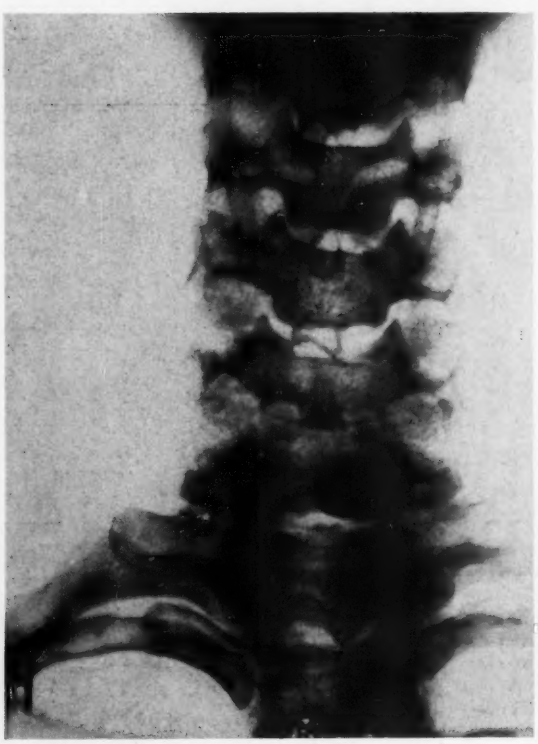

Fig. 2. Group 1: Small exostotic formations on the uncinate processes.

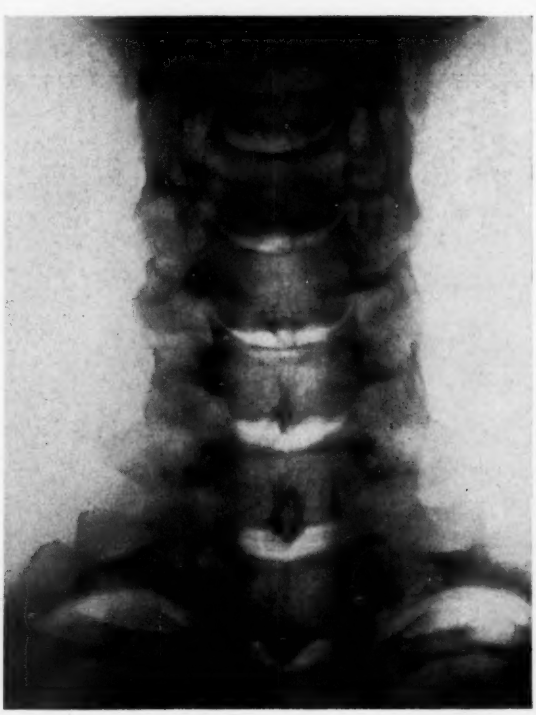

Fig. 3. Group 2: Larger exostotic formations on the uncinate processes.

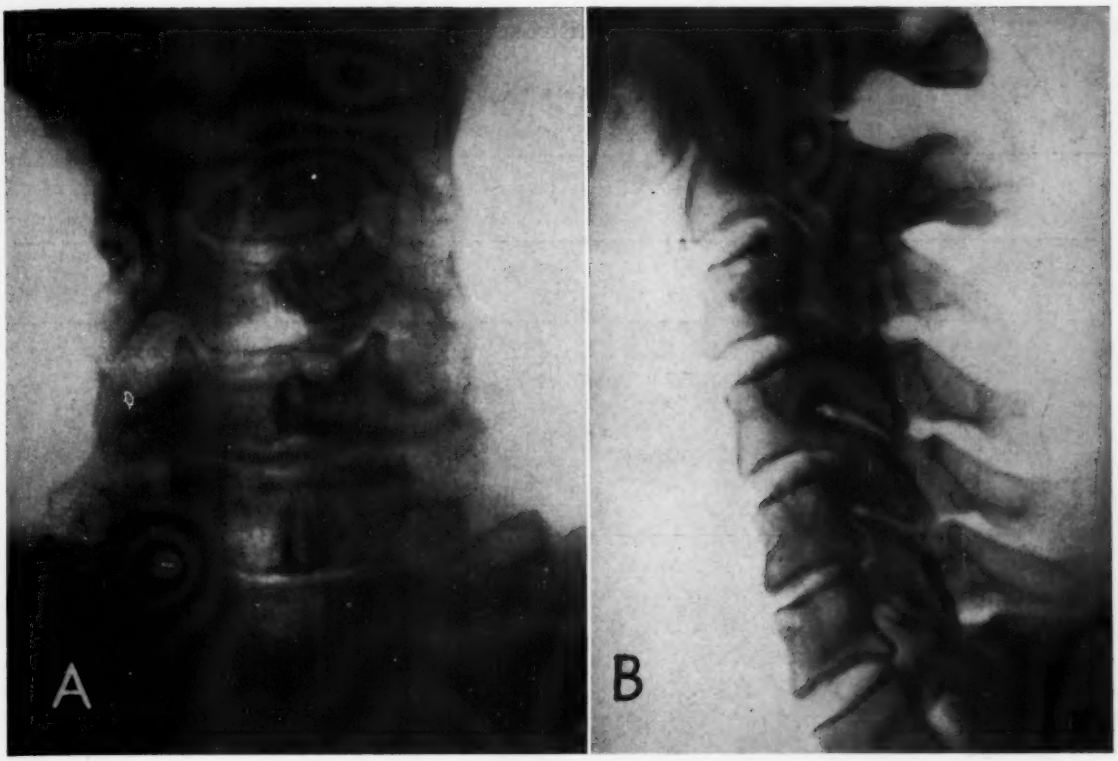

FIG. 4, (*A*) and (*B*) Group 3: Moderate disc lesions.

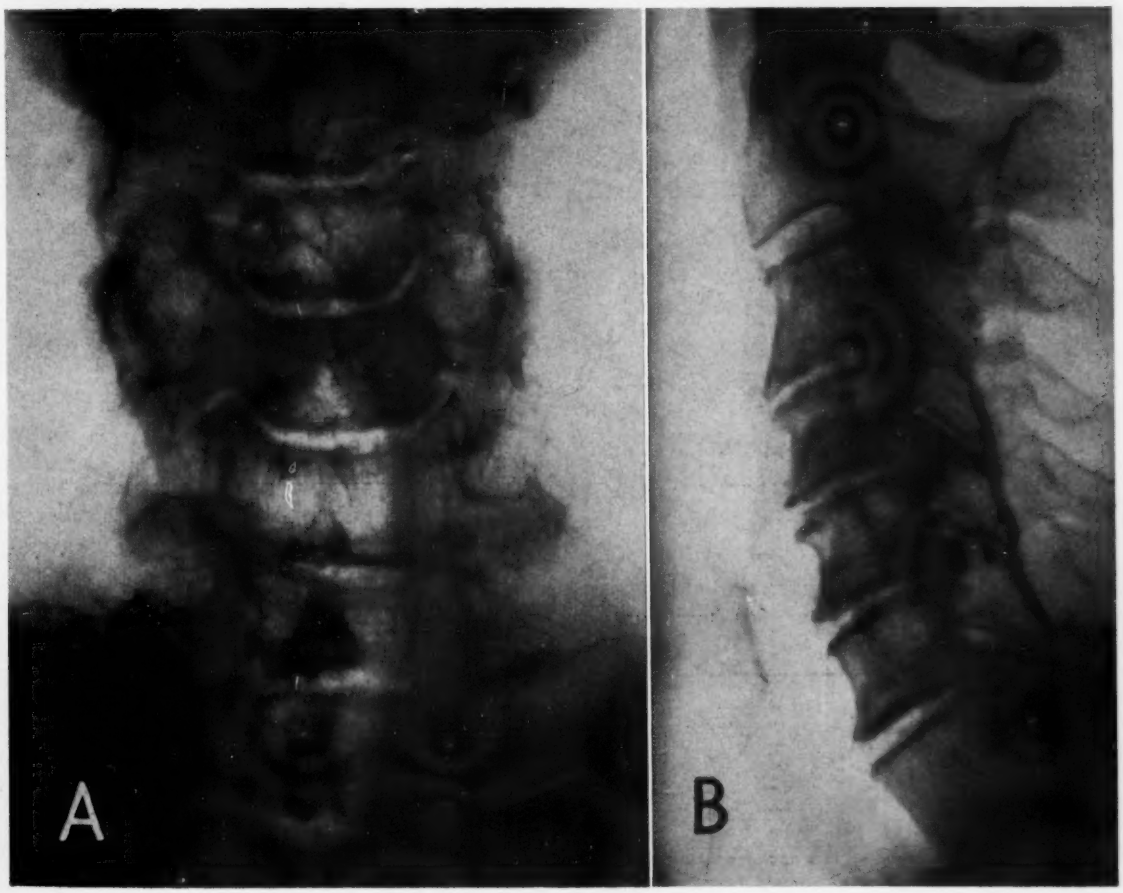

FIG. 5, (*A*) and (*B*) Group 4: Marked disc lesions.

TABLE IX

ROENTGENOGRAPHIC CHANGES IN RELATION TO AGE

	2 20–29		3 30–39		4 40–49		5 50–59		6 60–69		7 70		Total	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
0.	1	9	0	—	1	1	0	—	0	—	0	—	2	0.5
1.	6	55	15	37.5	29	23	13	11	7	8.5	1	5	71	17.5
2.	3	27	12	30	39	30	24	19	7	8.5	2	9	87	21
3.	1	9	10	25	38	30	43	34	27	33	4	18	123	30
4.	0	—	3	7.5	21	16	45	36	41	50	15	68	125	31
	11		40		128		125		82		22		408	

7th, 14th, 21st, and 28th days). After a rest of six weeks a second course is given, and in some instances a third course after an additional rest of six weeks. About 50 per cent of the patients received one course of treatment only. Serious side effects or injuries as a result of the treatment have not been observed. Improvement usually occurs after two weeks during the course of treatment. Our impression is that more permanent results are obtained when three courses of treatment are given at intervals of six weeks. If this does not achieve the purpose, roentgen treatment is considered useless.

Symptoms (Table XI). 1. Stiffness and/or pain confined to the neck. 2. Occipital pain—Barre's syndrome. 3. Shoulder pains. 4. Pain in the arms. 5. Paresthesia of the fingers. 6. Other symptoms, mainly thoracic pain and stenocardiac pain.

Pain in the arms and paresthesia of the fingers are a frequent occurrence in women. Otherwise the symptoms are largely the same in both sexes.

The symptoms are aggravated by certain types of work, particularly in women (Table XII). Daily carrying of packages, etc., is the greatest cause of aggravation, next comes knitting.

Only lesions showing a definite relation to the occurrence of symptoms are included.

Previous to roentgen therapy, treatment consisted mainly of novocain injections, massage, hot baths, thermopenetration and similar physical treatment. Such treatment in addition to roentgen irradiation was given in only 4 per cent of the present series, and may thus be assumed not to have interfered with the results to any noticeable extent. On the other hand, 24 per cent of the patients received simultaneous roent-

TABLE X

COURSES OF TREATMENT

	No.	Per Cent
1. 1 course (6 sittings)	302	48
2. 2 courses	185	30
3. 3 courses	96	15
4. 4 or more courses	42	7
	625	

TABLE XI

SYMPTOMS

			Women		Men	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
1.	565	90	426	90	139	92
2.	393	63	301	64	92	61
3.	541	87	423	89	118	78
4.	499	80	400	84	99	66
5.	422	68	343	72	79	52
6.	46	7	34	7	12	8
of	625		474		151	

gen irradiation of the shoulder, arm or dorsal column at the time of the irradiation of the neck. This may to some extent obscure the results.

Nocturnal pain disturbing the sleep was present in 82 per cent of the patients.

In 24 per cent of the patients the lesion was the reason for absence from work. This figure, however, is not representative because many housewives very rarely report sickness.

In 60 per cent of the cases, the patient stated that the position of the head and the arrangement of the pillow during sleep was of certain importance.

One criticism of the present series may be that we have no control group. An adequate group of patients with the complaints mentioned, which has not received any treatment, should have been re-examined after a similar observation period. Such control material, however, is not, for obvious reasons, available, as the majority of these patients are so uncomfortable that they sooner or later undergo some kind of treatment.

TABLE XII

Aggravation of Symptoms Caused by Certain Work:	
515 of 625: 82%	Women 430 of 474: 91% Men 85 of 151: 56%
Injury of head or neck 30 of 625: 5%	
Other treatment instituted previously 273 of 625: 44%	
Other treatment simultaneous with roentgen treatment 24 of 625: 4%	
Concurrent roentgen treatment (dorsal column, shoulder, arms) 149 of 625: 24%	
Nocturnal pain 510 of 625: 82%	
Absence from work 153 of 625: 24%	
Importance of position of head in bed 375 of 625: 60%	

SUMMARY

Spondylotic changes in the cervical spine occur in practically all adult human beings, and show an increasing incidence with increasing age. Symptoms, however, are only produced in a comparatively small percentage of the cases, and are then mainly confined to the ages forty to sixty years, with a marked female preponderance. Certain work, particularly carrying packages, knitting, etc., is an exciting cause, though it bears no relation to the severity of the spondylotic changes. Roentgen treatment produces no visible effect as to the spondylotic changes, though it alleviates the pain in 90 per cent of the cases. Better and more permanent results are obtained the earlier the treatment is instituted. Recidivation occurs sooner or later in about 50 per cent of patients in which relief is obtained, but is usually moderate and can usually be controlled by repeated roentgen treatment.

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DIRECTED BEAM THERAPY*

A ROTATIONAL THERAPY CHAIR

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ONE of the problems in radiation treatment of deep-seated cancer is the unavoidable irradiation of healthy tissues surrounding the pathological focus. The protection of the healthy tissues around a tumor is of paramount importance for the successful treatment of the patient, since many immediate and late untoward effects of radiation therapy are the direct result of irradiation of the normal tissues. Furthermore, it may be that the radiation dose required to destroy a deep-seated tumor is greater than can be tolerated by the surrounding normal tissues. Frequently, therefore, one must be resigned to delivering a dose inadequate to destroy the tumor in order adequately to protect the surrounding tissues. In the course of years, attempts have been made to deliver the greatest possible radiation dose to the tumor and the smallest possible dose to the surrounding tissues. The problem, however, has not been solved although progress has been made by increasing the generating potential, the filtration of the roentgen-ray beam and the target-skin distance. Direction of the radiation beam toward a deep-seated tumor through multiple skin portals or rotatory irradiation most nearly approaches a solution of the problem, by centering the rays on the lesion which lies in the point of beam convergence or axis of rotation. In rotatory irradiation the axis field is continually irradiated, whereas all points situated outside the axis field are exposed to radiation only during the time that the beam passes through that segment of tissues. The ratio of tumor dose to surrounding normal tissue dose, and more especially to skin dose, is a function of a number of factors, such as size of the beam, quality of radiation, tube target-tumor axis distance, and size (diameter) of body irradiated.

Many investigators have studied dose distribution in rotational therapy, and although many problems of differential irradiation have been solved, many others remain for further investigation. It is now recognized that certain lesions are particularly suitable for rotational therapy, while others may be better treated by partial rotation or by oscillation of either the roentgen-ray beam or the patient. Finally, a single plane horizontal motion using megavoltage radiation and a very narrow line beam may prove to be of value in securing differential irradiation.

This report describes a specially designed treatment chair for rotational radiation therapy which facilitates (1) complete rotation at various speeds, (2) partial rotation, or oscillation, and (3) linear reciprocating motion.

The device* consists of three main parts: (a) the chair, (b) the drive mechanism, and (c) the position indicator. The device rests on a steel frame on the underside of which are mounted four wheels which engage in a grooved track (Fig. 1). The wheels are motor driven. A start and reverse switch is provided so that the entire device can be mechanically moved along the tracks to the desired distance from the roentgen-ray tube.

The *chair* consists of the seat, foot and knee supports, arms and head rest (Fig. 1). In the design of this unit every possible means was used to give proper comfort and support to the patient and to maintain a fixed position.

* The chair was built by Max Toby of the Industrial Specialties Company of San Francisco, California.

* The work done in developing this chair was financed by a grant from the American Cancer Society.

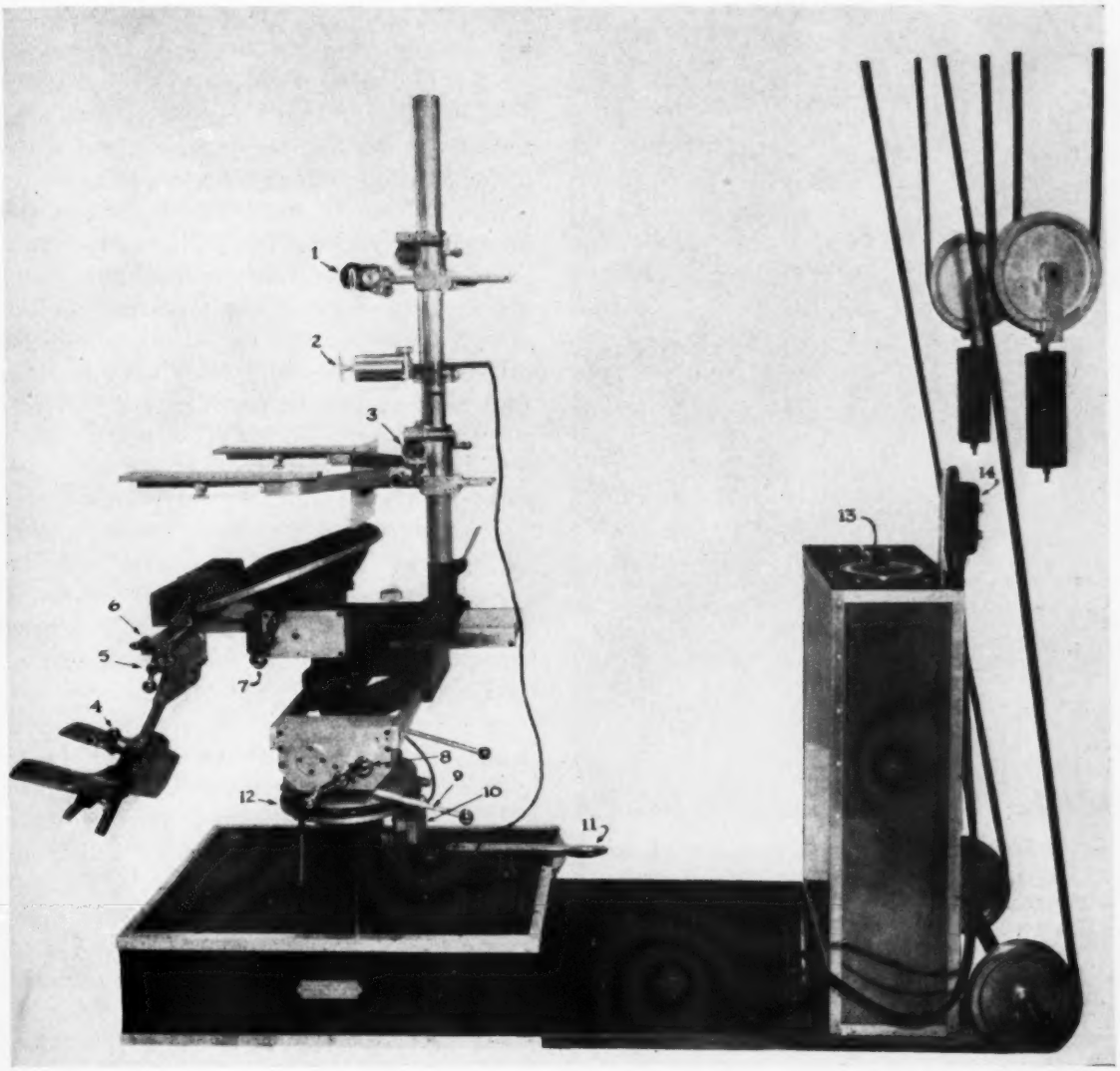

Fig. 1. Shows details of rotational therapy chair: (1) head support; (2) position indicator; (3) arm rest; (4) hand crank to adjust foot supports vertically; (5) hand crank to adjust foot rest at any desired angle; (6) hand crank to adjust knee supports; (7) hand crank to adjust chair seat to front or back; (8) hand crank to adjust chair seat laterally; (9) hand brake to fix chair at any point of rotation; (10) limit switches adjustable on (12) protractor disc; (11) shift lever to connect the rotating, oscillating or reciprocating mechanism to the variable speed drive; (13) calibrated dial setting for speed drive; (14) start and reverse switch to move chair along tracks.

The seat itself is of the bucket type adapted from a tractor driver's seat. The arm supports are made of aluminum tubing and are adjustable for width. Back rests can be raised and lowered. They are mounted to slide on a vertical aluminum column located behind the seat and fixed to the bracket upon which the seat is attached. The arm supports and a back support, made of lucite, are horizontally adjustable with relationship to the seat by means of a self-locking hand crank.

The head support is also mounted to slide on the vertical column. A hand crank is used for this adjustment; it is self-locking. The two pads, upon which the patient's head rests are adjustable for width. A self-locking knurled knob is provided for this

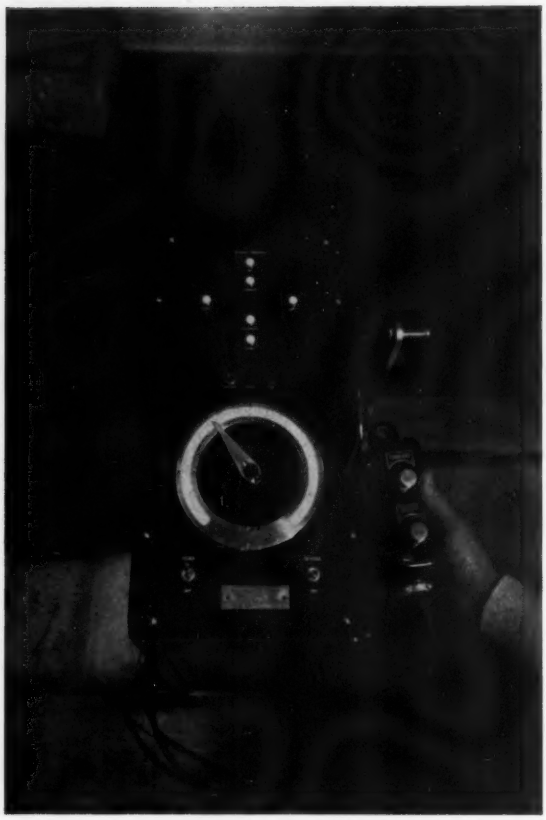

FIG. 2. Shows in detail the start and reverse switch (Fig. 1, *14*), the speed regulating dial, the main power switch, the oscillation and reciprocation "reverse" motion switch and a position control.

purpose. The pads can be angularly adjusted to conform to the shape of the patient's head. The head rest can be moved to any required distance from the column and a self-locking crank is provided for this purpose. A support is provided for each foot and these can be adjusted to the desired distance from one another. The foot supports are also adjustable vertically with relation to the leg supports. A self-locking hand crank arrangement is provided for this adjustment. In operation it is merely necessary to wind the crank until the supports are at their correct height. The foot supports can also be adjusted to any angle. Once again by the simple rotation of a hand crank, the foot support unit can be swung to the most comfortable position for the patient. This mechanism is self-locking.

The leg supports can be adjusted to any convenient width. A hand crank is provided for this purpose and it is self-locking.

The chair seat can be adjusted on a horizontal plane in any direction with reference to the axis of rotation. This means that any point within the patient's body can be moved to a position in the line of the rotational axis. As the foot rest mechanism and the vertical column are mounted on the same base or bracket as the seat they also will move with the seat when it is adjusted. Two hand cranks are provided for this purpose; they are self-locking.

This chair will rotate, oscillate or reciprocate. These motions are activated by an electronic variable speed, motor drive mechanism. The time per cycle can be varied from ten minutes to 100 minutes. A calibrated dial is provided and the desired time per cycle is obtained by merely setting the pointer in the correct position.

The *drive mechansim* is provided with a hand shift lever. When the lever is located in its central position the drive mechanism is disconnected and the chair may be freely rotated by hand on its axis. A hand brake is arranged so that the chair can be fixed at any point of rotation. When the shift lever is moved to the right, a clutch is locked which connects the rotating and oscillating mechanism to the variable speed drive. If the shift lever is moved to the left, another clutch engages connecting the reciprocating mechanism to the variable speed drive. A protractor disc is mounted underneath the seat and fixed to the chair supporting column and so arranged that it is symmetrical with the axis of the chair. Adjustably mounted on the disc are two limit switches, one to stop the chair after a complete rotation, the other to reverse the motion of the chair after a partial rotation to make it oscillate.

For complete rotation the stop switch is set at the zero position on the protractor disc. The chair is then rotated by hand until a pointer also indicates zero. The shift lever is moved to its right hand position and when the starting button is pressed the

chair will begin to rotate. After the chair has made one complete revolution the pointer will once again be at zero. The plunger mechanism will have opened the switch and the chair will be at a standstill. When partial rotation is used, the stop and reversing limit switches are located on the protractor disc to give the partial rotation desired. The chair is rotated by hand until the pointer coincides with an indicator mark on the stop switch. The shift lever is moved to its right hand position and when the starting button is pressed the chair will begin its rotation. It will continue in this direction until the pointer is in a position above the reverse limit switch. At this time a plunger mechanism will close the switch and the rotation will be reversed. The chair will continue in the reverse direction until the pointer is above the stop limit switch.

Reciprocating or straight line motion is obtained by setting the two limit switches, located behind the seat, in their desired positions. The shift lever is moved to its left hand position and the hand brake is locked. When the starting button is pressed, the seat will begin its motion across the axis of the chair and will continue in this direction until the pointer is above the reversing switch. At this point the motion will be reversed and the seat will stop when the pointer once again reaches a position above the stop switch.

The electronic controls provided to perform the above functions are mounted in a control cabinet fixed to the chair base. It is situated far enough away so that it will not interfere with the chair's operation. Mounted on top of this cabinet is the control panel. On this panel are arranged the calibrated dial, a power switch and reversing switch. A group of lights is provided to indicate any movement of the patient. A green light is also arranged to indicate that the chair is in its proper starting position and a red light is also provided to show that the chair is in motion (Fig. 3).

In a control room outside of the roentgen treatment room a duplicate panel is mounted. This panel has a duplicate set of

Fig. 3. Shows in detail the panel in the control room mounted above the technician's desk, next to the roentgen-ray machine controls. There are six signal lights which light up when the patient moves more than 1/32 inch in any direction. These lights are the registering mechanism of the position indicator. In addition, there is a start and stop push button. There is a green signal light to indicate that the chair is in proper starting position and a red signal light to indicate that the chair is in motion.

lights to indicate any movement of the patient and extra red and green lights. The panel is also provided with a starting button for chair rotation and an emergency stop button (Fig. 3).

The *position indicator* (Fig. 1, *2*) is a mechanism which will warn the operator when the patient shifts his position in the chair by 1/32 inch. A group of six lights are arranged on both control panels, one for each possible movement, up, down, forward, backward, right or left. The mechanism to perform this function is encased in a small box. The box is equipped with arms

and swivel clamps. When it is to be used, it is clamped on the vertical column of the chair in a position close to where the patient is to be treated. Extending from the front of the box is an arm which is pivotally attached to a plate. The plate is fixed to a convenient place on the patient's body and fixed to the skin with adhesive tape or straps. When the patient moves, the plate moves with him and his movement through the mechanism enclosed in the box actuates one or two of six switches. When the switch is closed corresponding lights on the panel boards flash on and warn the operator.

The setting up of the patient for each treatment in the rotational chair does not take more time actually than is needed when treatment is given through conventional stationary portals. The preparation of the patient for treatment, however, is more time consuming than with stationary portals, since actual localization of the tumor is of crucial importance.

As stated previously, one of the factors of the increase of tumor dose—skin dose ratio is the size of the beam, namely the smaller the radiation beam, the greater is the tumor dose—skin dose ratio. The tumor is first localized roentgenographically and roentgenoscopically on the projection levels of the tumor on the body surface. Markings are placed. These skin marks are the initial land marks for localization and direction of the therapy beam when the patient is seated in the treatment chair. Spot roentgenograms are then taken in at least three directions. The patient's position or the beam direction is now adjusted to secure the tumor in the axis field of rotation. When this is accomplished, final marks are made on the skin. At each subsequent treatment after the patient is seated in the chair, only the coincidence of the beam with the skin marks needs to be checked to assure the position of the tumor to be in the rotational axis field.

One of the problems of rotation therapy is to select conditions optimal for a high differential tumor dose—skin dose ratio. In general, this ratio depends on:

1. Tube focus—tumor axis distance.
2. Half-value layer of radiation.
3. Width of the beam.
4. Size of the object.
5. Shape of the object.
6. Density of the object.

A complete statement of the dose distribution requires the determination of the dose at many points in the object. Dose determination in rotational irradiation is an intricate problem. At present, measurements are being carried out using 400 kv. roentgen rays, various half-value layers, focus-skin distances and different sizes and shapes of presdwood phantoms. Results of these studies will be reported in a later communication.

SUMMARY

1. A rotational roentgen therapy chair is described which facilitates three motions: (a) complete rotation, (b) partial rotation (oscillation), and (c) linear motion (reciprocation). These motions are activated by a variable speed, motor drive mechanism. The speed for any of the motions is variable in the range between ten minutes and 100 minutes. At a particular setting the rate of motion is constant.

2. A position indicator for insuring accurate beam direction is described. The position indicator registers at the technician's control desk any motion of the patient exceeding 1/32 inch.

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A COMPARISON OF THREE SURVEY INSTRUMENTS EXPOSED TO VARIOUS RADIATIONS

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DURING the past four years the increase in usage of radioactive isotopes has demanded the utilization of radiation survey instruments for monitoring areas in which daily work is being carried out. Also, the hazards connected with the use of the roentgen ray have become more apparent due to the education associated with the requirements which must be fulfilled before a user may obtain radioisotopes.

Prior to 1947, instantaneous-reading survey instruments were not readily available; most of those in use were developed in independent laboratories. Had such instruments been commercially available there would have been a better control of the amounts of radiation received by roentgen and radium department personnel, who would then have employed safer techniques for their own protection.

The role of the health physicist as it is known today requires the use of instrumentation that will detect and determine the quantity of many kinds of radiant energy, whether it be corpuscular or electromagnetic. Radiation survey instruments are now commercially available for the detection of ionizing radiation. During this investigation three instruments of the ionization type were studied; the Geiger-Müller instruments were not included as this type is extremely energy dependent.[1]

To fulfill the recommendations of the National Bureau of Standards[2,3] all instruments should give comparable readings regardless of the conditions under which they are used. The purpose of this study* is to present data which will show many of the pitfalls and discrepancies that appear to be inherent in each of these three instruments when used for detecting unknown amounts of radiant energy. Three commercially available ionization chamber survey instruments[4] used in this laboratory were chosen for the study. It should be emphasized here that none of these meters are necessarily indicating correct values or are preferred, but are used only to show variations in commercially available instruments.

The Beckman MX-2, a portable beta-gamma air ionization rate meter, product of National Technical Laboratories,[5] South Pasadena, California, has an ionization chamber constructed of bakelite coated inside with colloidal carbon. The chamber volume is 0.82 liter. A window 11.0 by 16.5 cm. made of 0.254 mm. celluloid allows soft radiation to be measured. A bakelite shield covers the thin window for measurements of hard radiation. The 0.254 mm. celluloid window allows only beta rays of energies greater than about 0.2 mev. to penetrate into the ionization chamber. Thus, only beta rays which are of sufficient energy to significantly penetrate the surface skin tissue of the body are able to enter the chamber. The meter will therefore only measure beta rays which are likely to be an appreciable health hazard.

The instrument is precalibrated before shipment against the gamma rays from radium.

The Rauland model Z-100 Zeus alpha, beta, gamma survey meter product of the Rauland Corporation,[6] Chicago, Illinois, is a health survey instrument to detect the presence of ionizing radiation. The volume of the ion chamber is approximately 3.0 liters. The size of the window is 12.5 by 15.0 cm.; for alpha radiation discrimination there is provided a thin slide made of alum-

* This work was done in part under Contract AT (30-1)-609 from the Atomic Energy Commission.

inum foil, 0.076 mm., and for discrimination against beta radiation there is a 0.318 mm. plastic slide.

The meter is calibrated against the gamma rays from radium, and, as stated in the manufacturer's catalogue, must be specially calibrated for each energy of the beta emitting isotope to be measured. Special calibration is also required for alpha emitting isotopes.

The SU-1B portable beta-gamma survey meter employing an ionization chamber, product of Tracerlab, Inc.,[7] Boston, Massachusetts, has a cylindrical chamber 0.6 liter in volume and constructed of bakelite tubing coated on the inside with aquadag. For the detection of beta radiation there is a pliofilm window approximately 0.00635 mm. thick; the shape of the window is semicircular with a radius of 2.25 cm. A circular bakelite shield having a thickness of 3.18 mm. and a diameter of 5.50 cm. is provided for gamma radiation measurements with all beta radiation except high energy betas being cut out.

The Tracerlab SU-1B is calibrated at the factory with known ionization intensity produced by gamma rays from radium in equilibrium with its short lived decay products. Beta sensitivities depend on geometry, energy of particles, etc.; therefore must be calibrated.

Throughout the remainder of this paper the Beckman MX-2 will be referred to as MX-2, the Rauland Zeus Z-100, as Z-100, and the Tracerlab SU-1B, as SU-1B.

Before further discussion of the calibration of these instruments, some of the other difficulties[8] that were encountered are presented. The MX-2 presents a problem related to the moisture content of the atmosphere. This instrument when left in the laboratory will often become very erratic and at times unusable; this condition can be corrected by storing it in a warm cabinet. Also, the needle of the microammeter is of such delicate balance that it will oscillate upon a slight movement of the instrument. This is not an insurmountable fault, but it does demand that the operator take readings only after the needle has become stable. For the most part, the scale ranges are very good except that, when switching to the higher range values, there is a maximum discrepancy of 20 per cent.

The Z-100 is not affected by changes in humidity to as great an extent as the MX-2. The scale changes of this instrument, however, do not have sufficient overlap to provide accurate readings when shifting to the next higher scale value.

The SU-1B is stable under average humidity conditions. But there is not sufficient overlap of the various scale settings to provide adequate accuracy of instrument reading when shifting to the next higher scale value.

The time required for the instruments to become stable when exposed to radiation has been well designed for the MX-2 and the Z-100. The SU-1B has a time constant of about twenty seconds before the needle comes to rest, when being exposed to radiation. This is not a serious fault when monitoring is carried out by an experienced individual, but an inexperienced person could very well obtain readings that would indicate less intensity than is actually present.

One fault which is common to all three instruments is the difficulty of obtaining battery replacements. Each of the instruments requires at least one special type of battery. These are very difficult to obtain from electronic supply dealers. Under normal conditions, it requires from four to six weeks for dealers to obtain such highly specialized batteries from the suppliers. It would be much more convenient for users if the manufacturer would adapt the instrument to readily obtainable battery types, even at the expense of an increase in weight.

In this survey, before exposure to various radiations the instruments were calibrated by the gamma rays from radium.[9,10] The established value of 8.4 r/hr. from 1 mg. of radium at 1 cm. with 0.5 mm. Pt as filter was used as a standard source. For checking various scale values of any one instrument, the distance from the source to

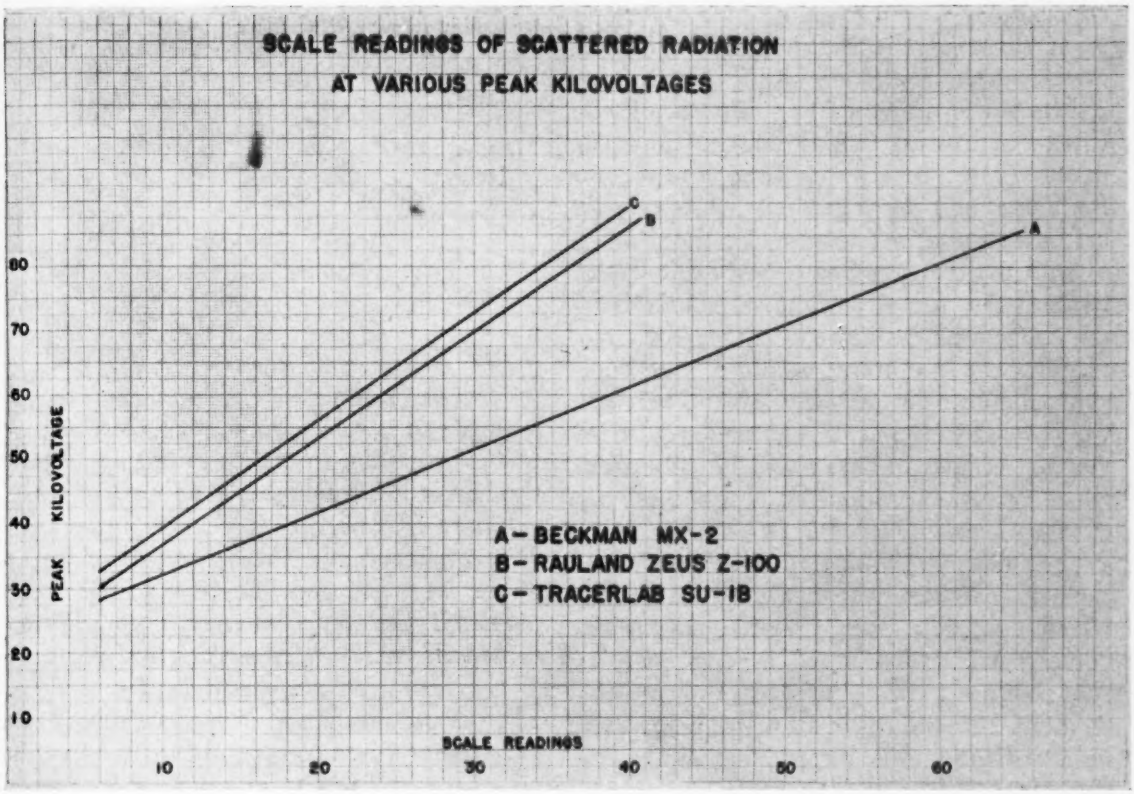

Fig. 1

the center of the ion chamber required to obtain the wanted intensity was established by use of the inverse square law.

All three instruments were exposed to direct roentgen radiation produced at 95 kv. (peak) filtered by 1/16 inch Pb at a distance of approximately 15 feet with each of the instruments set with its beta shield in place. Under these conditions, the Z-100 and the SU-1B meters indicated the same intensity, whereas the MX-2 was 15 per cent higher. When the instruments were exposed to roentgen radiation at 30 kv. (peak) with an inherent filtration of 1 mm. Al, the MX-2 gave a reading 36 per cent higher than the Z-100 and the SU-1B meters.

It was felt that the instruments should be compared when exposed to scattered roentgen radiation, such as commonly experienced in surveying roentgen-ray installations; thus two conditions were simulated. For the first condition, the roentgen radiation was at 85 kv. (peak) with an inherent filter of 1 mm. Al. The instruments were positioned so as not to be irradiated by the primary beam or by any radiation which might be escaping through the tube housing. The angle of scatter with the primary beam was approximately 95°. For these readings, the beta shields of each instrument were removed in order to register soft as well as hard rays from a plastered wall. Again, the MX-2 was higher by 25 per cent, the Z-100 and the SU-1B meters gave identical readings. The second condition was for roentgen radiation produced from 40 to 80 kv (peak) with an inherent filter of 1 mm. Al, the scatter being 75° with the primary beam; the instruments were protected from all radiation except that scattered from a plastered wall.

Figure 1 is a plot of the scale readings versus peak kilovoltages. Again, it may be seen that the Z-100 and the SU-1B meters agree within 10 per cent, the MX-2 being

consistently higher with its plot diverging from those of the Z-100 and the SU-1B meters as the peak kilovoltage is increased.

From the previous description of the three instruments it may be seen that it is necessary to specially calibrate the meters for beta and beta-gamma isotopes. To calibrate these instruments for monitoring of beta and beta-gamma isotopes, it would be desirable to use a standard source having the same beta particle energy distribution as the monitored isotope, but such sources are not always available. There are Co^{60}, RaD+E and UX_2 standards with which the instruments could be calibrated if rep values at various distances were accurately known.[11,12]

Considerable difficulty will be experienced in measuring any of the isotopes which emit low energy betas; this is especially true with betas having energies that will not permit them to penetrate the window. Some of the low-energy betas may be absorbed in the intervening air before they reach the window, but some in following their tortuous course may not even enter the window.

It is well known that most laboratories employing survey meters calibrate them only with radium, and use the meters for monitoring beta and beta-gamma isotopes. With this point in mind the meters were used throughout the study without an attempt to calibrate for beta or beta-gamma radiation.

For this phase of the investigation all distances were measured from the source to the face of the window, as the above study is a comparison of instruments with no attempt to determine mr or mrep values.

The instruments with beta shields removed were exposed to a pure beta source (P^{32}).* The source size was 14 cm^2. held in a plastic support on the center line of the instruments; a centering jig was used when varying the distance from source to instrument window.

The data presented in Table I show the readings of each instrument at various distances from the source of radiation. Again the MX-2 has the higher readings.

Other P^{32} sources of various intensities were prepared and the same procedure as above was followed. These readings were averaged and for convenience it was assumed the MX-2 was reading 100 per cent of the radiation at the various distances. The per cent radiation as indicated by each instrument when compared to the MX-2 is presented in Table II.

The same procedure was followed with a

* The radioactive phosphorus used in this investigation was supplied by the Oak Ridge National Laboratory and obtained on allocation from the U. S. Atomic Energy Commission.

TABLE I

COMPARISON OF INSTRUMENT READINGS AT VARIOUS DISTANCES FROM P^{32}

Distance (cm.)	Scale Readings		
	MX-2	Z-100	SU-1B
5	424	200	220
10	198	95.0	60.0
20	57.0	32.0	14.3
30	25.0	16.8	5.6
40	15.0	8.5	3.0

TABLE II

PER CENT RADIATION MEASURED FROM P^{32}

Distance (cm.)	Per Cent Measured by Instruments		
	MX-2	Z-100	SU-1B
5	100	50	59
10	100	55	35
20	100	56	21
30	100	56	22
40	100	53	26

TABLE III

COMPARISON OF INSTRUMENT READINGS AT VARIOUS DISTANCES FROM I^{131}

Distance (cm.)	Scale Readings		
	MX-2	Z-100	SU-1B
5	616	326	600
10	297	170	159
20	70.0	41.2	24.5
30	25.0	14.3	6.4
40	12.0	6.0	2.5

TABLE IV

PER CENT RADIATION MEASURED FROM I^{131}

Distance (cm.)	Per Cent Measured by Instruments		
	MX-2	Z-100	SU-1B
5	100	52	100
10	100	55	54
20	100	58	36
30	100	50	35
40	100	53	27

beta-gamma emitter (I^{131}).† Table III shows the variation of instrument readings for various distances.

In computing Table IV, which is comparable to Table II, the MX-2 was again assumed to be indicating 100 per cent of the radiation.

All of the previous readings of intensity were taken disregarding the geometry of the three instruments. In an attempt to establish comparable geometry and to have the same cross-section area of radiation enter the sensitive volume of the instruments, the source was collimated by two lead shields 1/16 inch thick in which circular holes comparable to the diameter of the source were cut. The lead diaphragm nearest the instrument was covered with aluminum to decrease the amount of scatter and secondary radiation from the lead entering the sensitive volume. Table V presents data for uncollimated and collimated sources of I^{131} and P^{32}. The windows in all instruments were set to the lowest mg./cm.^{2} Under these conditions the window of the Z-100 has a mg./cm.^{2} that is less than that of the others. With these settings it will be noted in Table V that the Z-100 reads higher for uncollimated I^{131} than do the MX-2 and the SU-1B.

The three instruments when compared under these conditions at distances from 15 to 40 cm. showed a 21 per cent variation (in one instance a 25 per cent variation was noted) in readings.

To further substantiate the need of proper interpretation of instrument reading the following procedure was carried out. A thin glass capsule containing radon was used as a beta-gamma source. Table VI shows the readings of the instruments for different distances from the source of radiation. Instruments were set to register low-energy betas and gamma radiation except in one case where with the beta shields in

TABLE V

COMPARISON OF INSTRUMENT READINGS FOR COLLIMATED AND UNCOLLIMATED SOURCES OF I^{131} AND P^{32}

Radioactive Source	Distance (cm.)	Scale Readings		
		MX-2	Z-100	SU-1B
I^{131} (uncollimated)	15	335	513	143
I^{131} (collimated)	15	94.0	110	98.0
I^{131} (uncollimated)	20	184	265	50.0
I^{131} (collimated)	20	29.0	30.0	27.0
I^{131} (uncollimated)	25	35.0	47.0	12.0
I^{131} (collimated)	25	6.0	5.0	5.0
P^{32} (uncollimated)	25	270	176	53.0
P^{32} (collimated)	25	40.0	32.5	30.0
I^{131} (uncollimated)	30	60.0	82.0	21.0
I^{131} (collimated)	30	7.2	7.0	5.7
P^{32} (uncollimated)	30	187	146	30.0
P^{32} (collimated)	30	20.0	15.7	17.9
P^{32} (uncollimated)	40	96.0	71.0	21.0
P^{32} (collimated)	40	9.0	7.1	7.1

TABLE VI

COMPARISON OF INSTRUMENT READINGS AT VARIOUS DISTANCES FROM RADON

Distance (meters)	Scale Readings		
	MX-2	Z-100	SU-1B
1.8	155	97	—*
3.0	32.5	22.0	7.5
3.6	16.4	10.0	4.5
3.0 (high energy betas and gammas)	8.8	7.0	4.0

† The radioactive iodine used in this investigation was supplied by the Oak Ridge National Laboratory and obtained on allocation from the U. S. Atomic Energy Commission.

* The reading was omitted because the scale value was very low and the multiplier factor so large that it was felt the end result would not be valid.

TABLE VII

PER CENT RADIATION MEASURED FROM RADON

Distance (meters)	Per Cent Measured by Instruments		
	MX-2	Z-100	SU-1B
1.8	100	63	—*
3.0	100	68	23
3.6	100	61	27
3.0 (high energy betas and gammas)	100	80	46

* The reading was omitted because the scale value was very low and the multiplier factor so large that it was felt the end result would not be valid.

place they registered only gamma rays and high energy betas.

Table VII has been compiled in the same manner as Tables II and IV.

Again, it is emphasized that no attempt was made to determine the mr and mrep accuracy of the instruments. The instruments were preset by the gamma rays from radium in order to set a standard by which to compare the instruments.

The results of this investigation clearly indicate that there is a discrepancy in readings for these three ionization-type instruments when exposed to the same types of radiation.

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BALANCED CHEST ROENTGENOGRAPHY*

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THE difficulty in obtaining a uniformly diagnostic chest roentgenogram when both lungs are of unequal density is generally recognized. There are two groups of conditions in which this problem is encountered: the first includes those in which there is an increase, the second includes those in which there is a decrease in the density of one-half of the thorax. Among the former may be listed scoliosis, unilateral pleural changes associated with fluid or fibrosis, extensive one-sided pulmonary involvement of inflammatory or neoplastic origin, atelectasis of one lung, or thoracoplasty. The causes of decreased roentgen-ray density in one hemithorax include removal of the breast and its surrounding soft tissue, atrophy of the pectoral and intercostal muscles as a result of poliomyelitis, marked unilateral emphysema, and some cases of pneumothorax.

In all of the foregoing instances the roentgen-ray exposure which might be preferred for one side of the chest would prove either excessive or inadequate for the opposite side. This situation is accentuated by the often necessary use of stationary or Potter-Bucky grids in either conventional or laminagraphic studies.

A number of attempts have been made in the past to solve this problem, but none of them have proved entirely satisfactory. These efforts have varied from separate roentgey-ray exposures of either half of the thorax[4,6] to elaborate methods of reducing penetration through the less dense side, while simultaneously permitting adequate exposure of the more opaque side.[2,3] The only heretofore simple, practical approach to this problem was suggested by Determann.[1] He placed a sheet of copper between the patient and the film, under the less radiopaque side of the chest. Although Determann's technique (Fig. 2*B*) permits visualization of the less opaque lung while adequately exposing the more dense side, it may be noted that half of the mediastinum does not receive sufficient penetration to disclose its component details. Furthermore, the line demarcating the border of the interposed sheet of metal persists as an objectionable artefact. To more adequately cope with this problem a simple method has been evolved which serves equally well for all techniques of chest roentgenography and yet avoids the limitations previously encountered.

METHOD

The device employed consists of a light weight, 28 gauge sheet of tin which measures 4 by 4 or $6\frac{1}{4}$ by $6\frac{1}{4}$ inches (Fig. 1), depending on the size of the aluminum filter groove in front of the roentgen tube. The two dimensions noted are those most commonly encountered. A some-

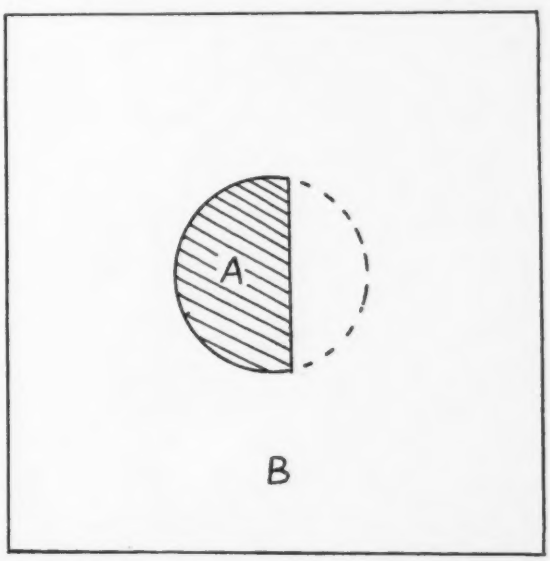

FIG. 1. B represents a 28 gauge sheet of metal. A represents the area cut out of the tin. The interrupted line completes the outline of the 2 inch circle from which area A has been cut out.

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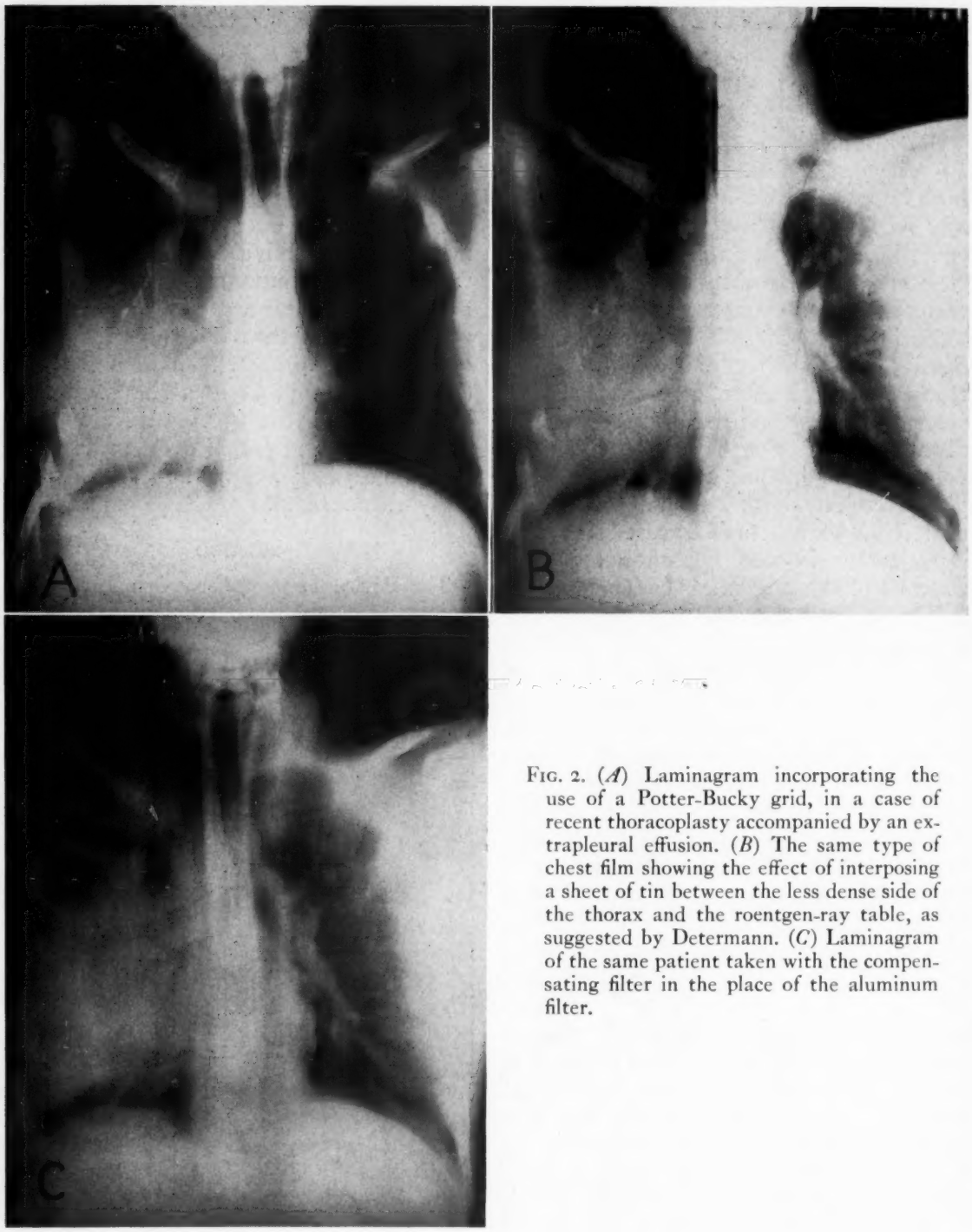

FIG. 2. (*A*) Laminagram incorporating the use of a Potter-Bucky grid, in a case of recent thoracoplasty accompanied by an extrapleural effusion. (*B*) The same type of chest film showing the effect of interposing a sheet of tin between the less dense side of the thorax and the roentgen-ray table, as suggested by Determann. (*C*) Laminagram of the same patient taken with the compensating filter in the place of the aluminum filter.

what larger than semicircular area (A, Fig. 1) is cut out of the sheet of tin in such a manner as to leave slightly more than half of the roentgen tube window uncovered. The tin (B, Fig. 1) is slipped into the aluminum filter groove, with the straight line of the cut-out corresponding in direction to the sagittal plane of the patient's thorax. By extending the cut-out $\frac{1}{8}$ inch

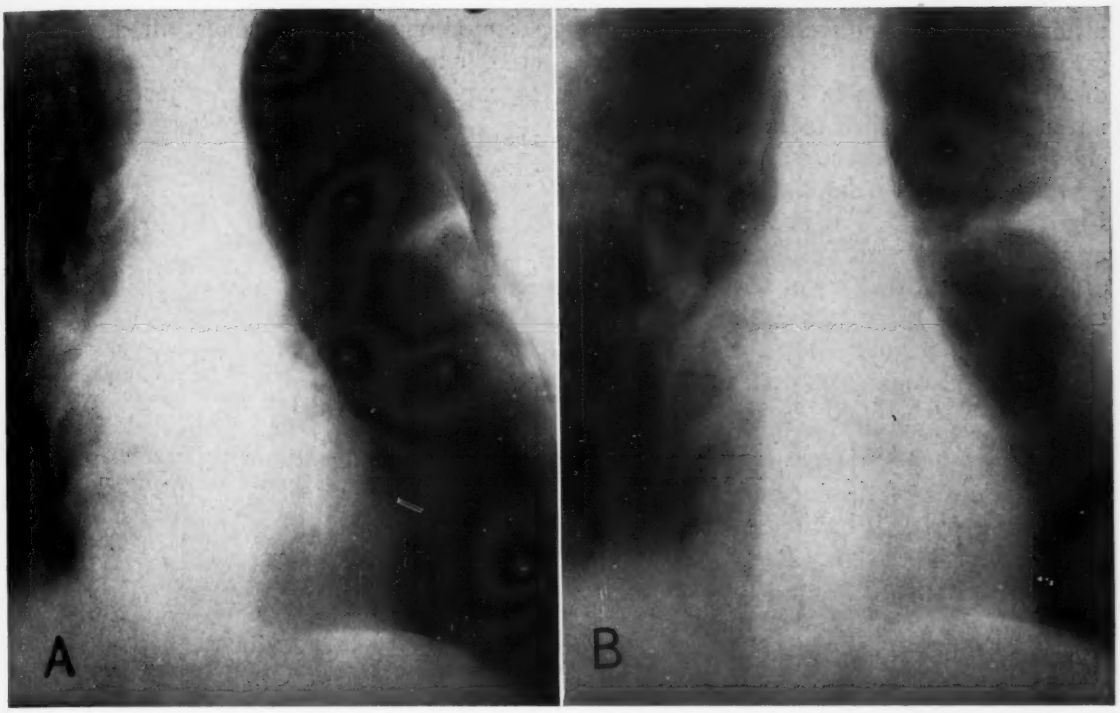

Fig. 3. (*A*) Therapeutic pneumothorax on the left made uniform exposure of both lungs difficult, with the conventional technique. (*B*) Both lungs were made equally visible with the aid of the compensating filter.

beyond the center, an even exposure of the entire mediastinum is made possible.

Used as a compensating filter in front of the roentgen tube, its border fails to cast a sharp line on the roentgenogram. Instead, at the usual working distances of from 36 to 72 inches, a graduated effect is obtained which is due to scattered radiation from the filter. This effect varies with the quantity and quality of the roentgen rays.

When available as a set of two, these compensating filters may be used singly for balancing moderate contrasts in density or may be used doubly, one over the other, for the correction of marked differences in density. In using the 28 gauge tin described above, as a single filter, clinical experience has shown that it is necessary to increase the exposure about 8 kilovolts. Used as a double filter, an increase of about 12 kv. is generally advisable. The degree of difference between the two sides of the chest determines the indication for single or double filters.

The ordinary aluminum filter can be left in place along with the tin insert, or may be temporarily removed. The latter procedure is recommended since the aluminum filter then furnishes the technician with a reminder of the presence of the compensating filter and insures its removal when it is no longer needed.

COMMENT

The problem of balancing the densities of some chest roentgenograms for the sake of uniformity of diagnostic details is illustrated in Figure 2*A*. It may be noted from this roentgenogram that adequate exposure of the partly collapsed right lung, beneath a recent thoracoplasty with its accompanying extrapleural effusion, resulted in complete loss of detail in the left lung. The relative advantages of Determann's technique, as well as its disadvantages, may be noted in Figure 2*B*. Although pulmonary detail is regained on the left, there is some sacrifice of mediastinal detail and the introduction of an objectionable artefact.

The advantages offered by our method are seen in Figure 2*C*. In addition to retaining the visibility of the left lung detail

otherwise lost by conventional roentgenographic methods (Fig. 2*A*), the artificial line of demarcation seen in Figure 2*B* is eliminated, and all of the mediastinum remains clearly discernible. Another instance of the usefulness of this balancing filter is seen in Figures 3*A* and *B*. The presence of a pneumothorax on the left resulted in a marked difference in the density of both sides of the chest (Fig. 3*A*). By interposing the device described above (Fig. 1), a diagnostically uniform chest roentgenogram was obtained (Fig. 3*B*).

SUMMARY

A simple set of tin cut-outs is described as an aid toward balanced chest roentgenography. These may be used singly or doubly, by superimposing one over the other, as the occasion demands. The circumstances in which they are found useful are enumerated, and two such instances are illustrated. These compensating filters help retard the roentgen-ray exposure over selected areas of the chest in a manner similar to the "dodging" employed by photographers when making projection prints.

1127 Park Ave.
New York 28, N.Y.

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Thirty-fourth Annual Meeting: Stevens Hotel, Chicago, Ill., June 8, 9 and 10, 1952.

EDITORIAL

PEROPERATIVE PORTAL VENOGRAPHY

DURING the past decade considerable interest has arisen in the perplexing problem of portal hypertension and its possible correction by various surgical procedures. It has been known to anatomists for more than 200 years that the portal and caval venous systems are normally linked together by multiple anastomoses which, under pathologic conditions, may enlarge considerably in an attempt to compensate for blocked blood flow, especially within the portal system. Very seldom, however, is this spontaneous attempt fully successful. The purpose of the surgical intervention is to shunt the blood from the portal to the caval system through a new pathway, thereby enhancing nature's work of creating a more adequate collateral circulation.

Obviously, the technical procedures that can be used for accomplishing this are many. A review of the literature, indeed, shows that anastomoses of almost any conceivable combination of two veins of a larger caliber have been employed. During these various trials it soon became evident that some means for determining more accurately the site and nature of the block, and thus establishing more definite operative indications, is desirable. The injection for roentgen visualization of an opaque medium into the vessels to be anastomosed, or their branches, suggested itself as the method most apt to produce satisfactory results. However, in view of the anatomy of the portal circulation and the presumed dangers of injecting large amounts of contrast material into such a vital system, the clinical application of the method has been slow in developing.

The first visualizations were made by accident. Blakemore and Lord,[1] for example, in 1945 performed venography during a shunting operation to determine the site of origin of the coronary vein. They injected 15 to 20 cc. of 35 per cent diodrast into a branch of the coronary vein and obtained a good venogram showing this vessel descending toward the splenic vein. The main portal trunk was not visualized in their case. Fariñas[2] in 1946 presented an excellent paper before the Forty-seventh Annual Meeting of the American Roentgen Ray Society dealing with abdominal venography following injection of diodrast into the long saphenous vein which was exposed through a small incision at the inner portion of the middle third of the thigh. Fariñas' purpose was to study, among other things, the permeability of the inferior vena cava for it is this vessel which relieves the portal circulation when portacaval shunt is performed. In one of the cases examined an anastomosis between the trunks of the inferior vena cava and portal vein was present and the venography through the long saphena resulted in satisfactory visualization of the venous circulation of both trunks, showing, in addition, the renal vein, branch of the inferior vena cava and the hepatic vein, branch of the portal vein.

A more comprehensive study of some of the tributaries of the portal system by means of venography was performed in 1949 by De Sousa Pereira, Melo Adriao and Lino Rodrigues[3] and the results ob-

[1] Blakemore, A. H., and Lord, J. W., Jr. The technic of using vitallium tubes in establishing portacaval shunts for portal hypertension. *Ann. Surg.*, 1945, *122*, 476–489.

[2] Fariñas, P. L. Abdominal venography. AM. J. ROENTGENOL. & RAD. THERAPY, 1947, *58*, 599–602.

[3] De Sousa Pereira, A., Melo Adriao, M., and Lino Rodrigues, J. O estudo flebografico do sistema porta. Communic. Academia dos Ciencios, Lisbon, 1949.

tained were presented by De Sousa Pereira[4] at the Thirteenth Congress of the International Society of Surgery at New Orleans in October of the same year. In particular, De Sousa Pereira was able to show that if during operation for appendicitis nosydrast is injected into a small vein of the cecum or meso-appendix, the opaque substance normally takes the shortest route to the superior mesenteric vein and thence to the main portal vein. However, in the presence of phlebitis, spasm or thrombosis of the veins of the cecum or meso-appendix, lesions which occurred in eleven of the fifteen cases examined by this method, the injected dye is carried into the collateral veins communicating with the inferior mesenteric and right colic veins, which are also tributaries of the portal system, or the parietal and pelvic veins which are branches of the general circulation. A similar intercommunication between the portal and caval venous systems was also observed in anorectal inflammations, when injecting the opaque medium into the hemorrhoidal venus plexus.

The injection of the opaque medium into the main portal trunk itself was proposed by Moore and Bridenbaugh[5] in 1950, the procedure being called portal venography. These authors obtained satisfactory visualization of the portal vein and its radicals with a fair degree of consistency. Their technic consisted of first inserting a polythene catheter into one of the tributaries of the portal vein, most frequently the right gastroepiploic vein, and slowly advancing it until the tip was in the portal vein. After tying the catheter in place, 20 cc. of 35 per cent diodrast was injected within two or three seconds. Venograms were made immediately upon the completion of the injection by using a portable roentgen apparatus and a hand-operated Potter-Bucky diaphragm. Moore and Bridenbaugh were primarily interested in ascertaining the proper technical factors; therefore their portal venographic examinations were carried out as an incidental procedure on patients who required laparotomy for various other reasons. They found that good visualization was favored by rapid injection of the contrast medium directly into the main portal trunk, by complete arrest of respiration during the roentgen exposure and by proper timing of the roentgen exposure in relation to the injection of the contrast medium.

The clinical usefulness of portal venography was recently demonstrated by several eminent investigators. Thus Santy and Marion[6] found venography in association with manometric determination of the portal pressure particularly valuable in Banti's syndrome. These authors coined the name of peroperative portography for the procedure, to express the fact that the portal visualization is being performed during the course of the operation which had been undertaken for the correction of the existing anomaly or disease. They employed portal venography in 15 out of 24 patients with Banti's syndrome operated upon during the last two years. Their technic consisted of introducing a fine Nélaton catheter, after ligation of the splenic artery, into one of the terminal branches of the splenic vein and advancing it for a distance of 5 to 6 cm. After measuring the pressure of the portal system manometrically, 40 cc. of 50 per cent diodrast was injected rapidly through the catheter and films exposed immediately and one to two minutes later. The results obtained were rather surprising. Portal venography demonstrated clearly that Banti's syndrome is not a well defined disease but represents a symptom complex which can be produced by several lesions of different etiology. In 10 patients it resulted from extrahepatic and in 5 patients from intrahepatic block of the portal venous system. The roentgen appearance of the extrahepatic block varied considerably depending on the type of obstruc-

[4] De Sousa Pereira, A. Thrombo-phlébites des veines tributaires du système porte. XIII[e] Congrès de la Société Internationale de la Chirurgie. New Orleans, Oct. 10–16, 1949, pp. 534–545.

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tion. The main causes of obstruction were stenosis of the portal trunk, either on a congenital basis or due to extrinsic pressure, and more frequently thrombosis due to chronic pylephlebitis of the portal trunk or the splenic vein. Since all of these lesions represent definite pathologic entities, Santy and Marion felt that they should be separated from the group of Banti's syndrome. The roentgen image of the intrahepatic block, on the other hand, was quite uniform and very characteristic. The entire portal system was dilated, in particular the splenic and portal veins, with the superior mesenteric vein coming next and the inferior mesenteric vein being last. The two branches of the portal vein and their terminal collaterals were likewise enlarged although the intrahepatic portal venous circulation was never completely blocked and the liver appeared impregnated with diodrast. Santy and Marion proposed that this entity of unknown etiology be called true Banti's disease. Since splenomegalic cirrhosis occurs also in association with certain portal stenoses, portal venography has the added advantage of permitting a more accurate differential diagnosis than is possible with any other means.

As regards surgical indications, Santy and Marion found that peroperative portal venography is of definite value in Banti's syndrome in three situations: first, to determine if a thrombosis of the splenic vein is present, in which case a splenorenal anastomosis following the splenectomy would prove useless; second, to ascertain the permeability of the portal trunk before a direct portacaval shunt is attempted; and third, to determine whether or not a splenorenal anastomosis following splenectomy is necessary in case of extrahepatic portal block with only slight raise of the portal pressure, in view of the presence of an already well developed spontaneous collateral circulation.

Leger and his co-workers[7,8] have extended the use of portal venography to animal experiments and to the clinical study of a number of pathologic conditions related to portal hypertension. They have worked out a technique which is similar to the one described by Santy and Marion except that a greatly simplified pressure measuring device is incorporated into the injecting apparatus so that the pressure of the portal system can be read directly on the polythene catheter, the outer end of which is held vertically. A pressure of the order of 10 to 20 cm. of water is regarded as normal, whereas a pressure of 30 to 70 cm. of water is considered to be indicative of portal hypertension. The best portal venograms are obtained by introducing the catheter into the right gastroepiploic vein although the coronary vein and in case of splenectomy a mesenteric vein or the trunk of the splenic vein may also be used.

The animal experiments were conducted by Leger in collaboration with Gally, Arvay, Oudot and Auvert[7] on large dogs. They included opacification of the portal trunk, visualization of the anatomic distribution of the tributaries particularly in their relationship to the inferior vena cava and aorta, and serial observations of the development of a very efficient collateral circulation following incomplete and sometimes a two-stage complete stenosis produced by ligation of the portal vein.

The clinical studies were carried out by Leger, Albot and Arvay,[8] by using the method systematically in various pathologic conditions, especially the cirrhotic states and Banti's syndrome. The authors gained a wide experience which they summarize as follows: With the present technic, only the portal trunk and the origins of its terminal branches are visualized clearly in the normal venogram. The rapid diffusion of the contrast medium into the hepatic radicals leads to opacification of this organ in its entirety, hiding the details

[7] Leger, L., Gally, L., Arvay, N., Oudot, J., and Auvert, J. La portographie. Technique. Étude expérimentale, anatomique et clinique. *Presse méd.*, March 28, 1951, *59*, 410–411.

[8] Leger L., Albot, G., and Arvay, N. La phlébographie portale dans l'exploration des affections hépato-spléniques. *Presse méd.*, Sept. 15, 1951, *59*, 1230–1232.

of the venous pattern. In the cirrhotic states the portal hypertension leads to stasis of the dye containing blood, rendering the intrahepatic branches of the portal vein visible on the roentgenogram. The better visualization as compared to the normal is also enhanced by the fact that many of the venous radicals of the third and fourth order are obliterated and the calibers of the principal branches are significantly reduced in size. In Banti's syndrome the findings are similar to those described by Santy and Marion. Other lesions identified by Leger, Albot and Arvay with the aid of portal venography comprise a case of primary pylephlebitis of the portal vein with slowly developing collateral circulation and secondary cirrhosis of the liver, and a case of recanalization of the thrombosed portal trunk with neo-formation of filiform collaterals.

All in all, it appears that peroperative portal venography although employed only for a comparatively short time has successfully surpassed the stage of experimental trial. With carefully observed precautionary measures and meticulously executed technic, it has become a valuable clinical method in well selected cases. The broadening of its diagnostic scope is worthy of further exploration.

T. Leucutia, M.D.

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

MEETINGS OF ROENTGEN SOCIETIES*

UNITED STATES OF AMERICA

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Secretary, Dr. Barton R. Young, Germantown Hospital, Philadelphia 44, Pa. Annual meeting, 1952: To be announced.

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Secretary, Dr. J. E. Wirth, 635 Herkimer St., Pasadena 1, Calif. Annual meeting: Stevens Hotel, Chicago, Ill., June 8, 9 and 10, 1952.

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Secretary, Dr. W. W. Anderson, Tuscaloosa, Ala. Meets time and place Alabama State Medical Association.

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Secretary, Dr. R. Lee Foster, 507 Professional Building, Phoenix, Ariz. Two regular meetings a year. The annual meeting at time and place of State Medical Association and interim meeting six months later.

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CHICAGO ROENTGEN SOCIETY
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CLEVELAND RADIOLOGICAL SOCIETY
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COLORADO RADIOLOGICAL SOCIETY
Secretary, Dr. W. P. Stampfli, 1933 Pearl St., Denver, Colo. Meets third Friday of each month at University of Colorado Medical Center or at Denver Athletic Club.

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Secretary, Dr. X. R. Hyde, Medical Arts Bldg., Fort Worth, Texas. Meets in Dallas on odd months and in Fort Worth on even months, on third Monday, 7:30 P.M.

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* Secretaries of societies are requested to send timely information promptly to the Editor.

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New England Roentgen Ray Society
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North Carolina Radiological Society
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North Dakota Radiological Society
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Oklahoma State Radiological Society
Secretary, Dr. W. E. Brown, 21st & Xanthus, Tulsa 4, Okla. Three regular meetings annually.

Oregon Radiological Society
Secretary, Dr. J. Richard Raines, 214 Medical-Dental Bldg., Portland 5, Oregon. Meets monthly from October to June on the second Wednesday of each month at 8:00 P.M. at the University Club.

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Pacific Northwest Radiological Society
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Pacific Roentgen Society
Secretary, Dr. L. H. Garland, 450 Sutter St., San Francisco, Calif. Meets annually, during meeting of California Medical Association.

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Secretary, Dr. W. F. Hamilton, Jr., University Hospital, Augusta, Ga.

Rochester Roentgen Ray Society, Rochester, N. Y.
Secretary, Dr. George Gamsu, 191 S. Goodman St., Rochester, N. Y. Meets monthly on last Monday from September through May, 8 P.M. at Strong Memorial Hospital.

Rocky Mountain Radiological Society
Secretary, Dr. Maurice D. Frazer, 1037 Stuart Bldg., Lincoln, Nebr.

St. Louis Society of Radiologists
Secretary, Dr. D. S. Bottom, 510 S. Kingshighway, St. Louis, Mo. Meets fourth Wednesday each month, except June, July, August, and September.

San Diego Roentgen Society
Secretary, Dr. R. F. Niehaus, 1831 Fourth Ave., San Diego, Calif. Meets monthly, first Tuesday at dinner.

San Francisco Radiological Society
Secretary, Dr. I. J. Miller, 2680 Ocean Avenue, San Francisco 27, Calif. Meets quarterly.

Section on Radiology, California Medical Association
Secretary, Dr. D. R. MacColl, 2007 Wilshire Blvd., Los Angeles 5, Calif.

Section on Radiology, Illinois State Medical Society
Secretary, Dr. Harold L. Shinall, St. Joseph's Hospital, Bloomington, Ill.

Shreveport Radiological Club
Secretary, Dr. R. W. Cooper, Charity Hospital, Shreveport, La. Meets monthly on third Wednesday, at 7:30 P.M., September to May inclusive.

South Bay Radiological Society
Secretary, Dr. Ford Shepherd, 526 Soquel Avenue, Santa Cruz, Calif. Meets second Wednesday each month.

South Carolina X-Ray Society
Secretary, Dr. Henry E. Plenge, Spartanburg General Hospital, Spartanburg, S. C. One meeting with South Carolina Medical Association in May, others arranged by President.

Tennessee Radiological Society
Secretary, Dr. J. M. Frère, Newell Hospital, Chattanooga,

Tenn. Meets annually at the time and place of the Tennessee State Medical Association.

TEXAS RADIOLOGICAL SOCIETY
Secretary, Dr. R. P O'Bannon, 650 Fifth Ave., Fort Worth 4, Texas. Meets Houston, Texas, Jan. 18 and 19, 1952.

UNIVERSITY OF MICHIGAN DEPARTMENT OF ROENTGENOLOGY STAFF MEETING
Meets each Monday evening from September to June, at 7 P.M. at University Hospital.

UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE
Secretary, Dr. E. A. Pohle, 1300 University Ave., Madison, Wis. Meets first and third Thursdays 4:00 to 5:00 P.M., September to May inclusive. Room 203, Service Memorial Institute, 426 N. Charter St., Madison.

UTAH STATE RADIOLOGICAL SOCIETY
Secretary, Dr. Angus K. Wilson, 343 S. Main St., Salt Lake City 1, Utah. Meets third Wednesday in September, November, January, March and May.

VIRGINIA RADIOLOGICAL SOCIETY
Secretary, Dr. P. B. Parsons, Norfolk General Hospital, Norfolk, Va. Meets annually in October.

WASHINGTON STATE RADIOLOGICAL SOCIETY
Secretary, Dr. R. C. Kiltz, 705 Medical-Dental Bldg., Everett, Wash. Meets fourth Monday each month, October through May, College Club, Seattle.

WISCONSIN RADIOLOGICAL SOCIETY
Secretary, Dr. Irving I. Cowan, 425 E. Wisconsin Ave., Milwaukee 2, Wis. Special meetings held during year; annual meeting each spring at Madison, Wis.

X-RAY STUDY CLUB OF SAN FRANCISCO
Secretary, Dr. M. A. Sisson, 450 Sutter St., San Francisco, 8, Calif. Meets Jan. to July, Lane Hall, Stanford Univ. Hospital; July to Dec. San Francisco Hospital.

CUBA, MEXICO AND CENTRAL AMERICA

SOCIEDAD DE RADIOLOGÍA Y FISIOTERAPIA DE CUBA
President, Dr. J. Manuel Viamonte, Hospital Mercedes, Habana, Cuba. Meets monthly in Habana.

SOCIEDAD MEXICANA DE RADIOLOGIA Y FISIOTERAPIA
General Secretary, Dr. D. P. Cossio, Marsella No. 11, Mexico, D. F. Meets first Monday of each month.

SOCIEDAD RADIOLÓGICA PANAMEÑA
Secretary, Dr. L. Arrieta Sanchez, Apartado No. 86 Panama, R. de P. Meets monthly in a department of radiology of a local hospital, chosen at preceding meeting.

BRITISH EMPIRE

BRITISH INSTITUTE OF RADIOLOGY INCORPORATED WITH THE RÖNTGEN SOCIETY
Ordinary meeting, on the Thursday preceding the third Friday, October to May at 8:15 P.M.
Medical Members' meeting, on third Friday in each month at 5:00 P.M., 32 Welbeck St., London, W 1.

FACULTY OF RADIOLOGISTS
Honorary Secretary, Dr. J. F. Bromley, 45, Lincoln's Inn Fields, London, W.C.2, England.

SECTION OF RADIOLOGY OF THE ROYAL SOCIETY OF MEDICINE (CONFINED TO MEDICAL MEMBERS)
Meets third Friday each month at 4:45 P.M. at the Royal Society of Medicine, 1 Wimpole St., London.

CANADIAN ASSOCIATION OF RADIOLOGISTS
Honorary Secretary-Treasurer, Dr. Jean Bouchard, Suite 305, 1555 Summerhill Avenue, Montreal 26, Que. Meetings January and June.

SECTION OF RADIOLOGY, CANADIAN MEDICAL ASSOCIATION
Secretary, Dr. C. M. Jones, Inglis St., Ext. Halifax, N. S.

SOCIÉTÉ CANADIENNE-FRANÇAISE D'ELECTROLOGIE ET DE RADIOLOGIE MÉDICALES
Secretary, Dr. Origéne Dufresne, 4120 Ontario St., East, Montreal, P. Q.

AUSTRALIAN AND NEW ZEALAND ASSOCIATION OF RADIOLOGISTS
Honorary Secretary, Dr. Alan R. Colwell, 135 Macquarie St., Sydney, N.S.W.
Honorary Secretaries, State Branches:
New South Wales, Dr. E. W. Frecker, 135 Macquarie St., Sydney.
Victoria, Dr. T. L. Tyrer, 3 Lockerbie Court, East St. Kilda.
Queensland, Dr. J. Adam, 131 Wickham Terrace, Brisbane.
South Australia, Dr. R. de G. Burnard, 170 North Terrace, Adelaide.
Western Australia, Dr. A. M. Nelson, 179 B St. Georges Terrace, Perth.
New Zealand, Dr. E. G. Lynch, 12 Bolton St., Wellington.

SOUTH AMERICA

ASOCIACION ARGENTINA DE RADIOLOGIA
Secretary, Dr. Lidio G. Mocsa, Avda. Gral Paz 151, Córdoba, Argentina. Meetings held monthly.

SOCIEDAD ARGENTINA DE RADIOLOGIA, JUNTA CENTRAL, BUENOS AIRES
Secretary, Dr. Oscar F. Noguera, Santa Fe 1171, Buenos Aires. Meetings are held monthly.

SOCIEDAD ARGENTINA DE RADIOLOGIA, FILIAL DEL LITORAL, SEDE, ROSARIO
President, Dr. Francisco P. Cifarelli. Meets monthly second Wednesday, 19 ha 663 Italia St., Rosario, Santa Fe.

SOCIEDAD ARGENTINA DE RADIOLOGIA, FILIAL DEL SUR, SEDE, LA PLATA
President, Prof. Dr. Jose P. Uslenghi, La Plata. Meets monthly.

SOCIEDAD ARGENTINA DE RADIOLOGIA, FILIAL DEL CENTRO, SEDE, CORDOBA
President, Prof. Dr. David L. Caro, Corro 86, Cordoba. Meets monthly.

SOCIEDAD ARGENTINA DE RADIOLOGIA, FILIAL DEL NORTE, SEDE, TUCUMAN
President, Dr. Julio Mendez Valladares, Rivadavia 358, Tucuman. Meets monthly.

SOCIEDAD ARGENTINA DE RADIOLOGIA, FILIAL DE CUYO SEDE, MENDOZA.
President, Dr. J. A. Orfila, Hospital Central, Mendoza. Meets monthly.

SOCIEDADE BRASILEIRA DE RADIOLOGIA MEDICA
Secretary, Dr. Nicola Caminha, Av. Mem de Sa, Rio de Janeiro, Brazil. Meets monthly, except during January, February and March.

SOCIEDADE BRASILEIRA DE RADIOTERAPIA
Secretary, Dr. Oscar Rocha von Pfuhl, Av. Brigadeiro Luiz Antonio, 644 São Paulo, Brazil. Meets monthly on second Wednesday at 9 P.M. in São Paulo at Av. Brigadeiro Luiz Antonio, 644.

SOCIEDAD COLOMBIANA DE RADIOLOGIA
Secretary, Dr. Alberto Torres Focke, Av. 34, No. 17-34, Bogota, Colombia. Meets last Wednesday of each month.

SOCIEDAD PERUANA DE RADIOLOGIA
Secretary, Dr. Julio Bedoya Paredes, Apartado, 2306, Lima, Peru. Meets monthly except during January, February and March, at Asociación Médica Peruana "Daniel A. Carrión," Villalta, 218, Lima.

SOCIEDAD DE RADIOLOGICA, CANCEROLOGIA Y FISICA MEDICA DEL URUGUAY
Secretary, Dr. Arias Bellini, Av. Agraciada 1464, Piso 13, Montevideo, Uruguay.

CONTINENTAL EUROPE

SOCIÉTÉ BELGE DE RADIOLOGIE
General Secretary, Dr. S. Masy, 111 Avenue des Allies, Louvain, Belgium. Meets monthly, second Sunday at Maison des Médecins, Brussels.

SOCIÉTÉ FRANÇAISE D'ELECTRO-RADIOLOGIE MÉDICALE, and its branches: SOCIÉTÉ DU SUD-OUEST, DU LITTORAL MÉDITERRANÉEN, DU CENTRE ET DU LYONNAIS, DE L'OUEST, DE L'EST, ET D'ALGER ET D'AFRIQUE DU NORD

Secretary-General, Dr. A. Dariaux, 9 bis, Boulevard Rochechouart, Paris IX^e, France.

Československá společnost pro röntgenologii a radiologii v Praze
Secretary, Dr. Roman Bláha, Praha XII, stát. nemocnice, Czechoslovakia. Meets monthly except during July, August, and September. Annual general meeting.

Polish Society of Radiology
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland.

Gdansk Section, Polish Society of Radiology
Secretary, Dr. A. Smigielska, Akademia Lekarska, Gdansk. Meets monthly last Sunday at 10:30, X-Ray Dept., Akademia Gdansk.

Warsaw Section, Polish Society of Radiology
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland. Meets monthly.

Societatea Romana de Radiologie si Electrologie
Secretary, Dr. Oscar Meller, Str. Banual Mărăcine, 30, S. I., Bucuresti, Roumania. Meets second Monday in every month with the exception of July and August.

All-Russian Roentgen Ray Association, Leningrad. USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson. Meets annually.

Scandinavian Roentgen Societies
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association.

Sociedad Espanola de Radiologia y Electrologia
Secretary, Dr. J. Martin-Crespo, Fuencarral, 7. Madrid, Spain. Meets monthly in Madrid.

Schweizerische Röntgen-Gesellschaft (Société Suisse de Radiologie)
Secretary, Dr. Max Hopf, Effingerstrasse 47, Bern, Switzerland.

Societa Italiana di Radiologia Medica
Secretary Prof. Mario Ponzio, Ospedale Mauriziano. Torino, Italy. Meets biannually.

India

Indian Radiological Association
Secretary, Dr. R. F. Sethna, Navsari Building, Hornby Road, Bombay 1, India

EASTERN CONFERENCE OF RADIOLOGISTS

The Eastern Conference of Radiologists will hold its meeting at the Statler Hotel, New York, New York, on March 28 and 29, 1952. Radiologists who expect to attend this conference are invited to write to Dr. Maurice Lenz, 840 Park Avenue, New York 21, New York, for their advance registrations.

The following is the preliminary program of the meeting:

Criteria for the Choice of Angiography versus Ventriculography in the Diagnosis of Brain Tumor. By Dr. Ernst H. Wood.

The Diagnosis and Treatment of Neuroblastoma. By Dr. Robert S. Sherman, Robert F. Phillips, and Robert Leaming.

Growing Skeleton in Gargoylism; Early Lesions and Their Evolution. By Dr. John Caffey.

Massive Hemorrhage from the Upper Gastrointestinal Tract. By Dr. John A. Evans and Dr. Forbes Delany.

The Roentgen Aspects of the Papilla of Vater. By Dr. Maxwell H. Poppel, Dr. Harold G. Jacobson, and Dr. Robert W. Smith.

Abdominal Aortography. By Dr. William Schlein.

Congenital Arteriovenous Communications. By Dr. Charles T. Dotter and Dr. Israel Steinberg.

The Roentgen Diagnosis of Broncholithiasis. By Coleman B. Rabin and Dr. Morton Ziskind.

Fish-bone Foreign Bodies of the Upper Esophagus and Pharynx: A Clinical and Experimental Study. By Dr. Arnold L. Bachman.

The Problem of Personnel Protection in Diagnostic Roentgenology. By Lillian E. Jacobson, Dr. Joel J. Schwartzman and Dr. Saul Heiser.

Some Rotation Therapy Techniques Applicable to Standard Deep Therapy Machine. By Dr. Morton M. Kligerman and Dr. Elaine Gilinson.

The Effect of Single Doses of Roentgen Rays on Experimentally Induced Glioma. By Dr. Martin G. Netsky and Dr. J. R. Freid.

Roentgen Therapy of Mongolism. By Dr. Ira I. Kaplan.

Segmental Resection and Radium Implantation in the Treatment of Carcinoma of the Bladder. By Dr. John N. Robinson and Dr. Morton M. Kligerman.

A Rapid Technique in Radiotherapy of Oral Carcinoma. By Dr. Sidney Rubenfeld.

Grid Therapy for Cancer of the Lung. By Dr. Sidney M. Silverstone, Dr. William Harris, and Dr. Charles Botstein.

Roentgen Therapy and Chemotherapy in the Management of Malignant Lymphomas. By Dr. Vincent C. Collins and Dr. Alfred Gellhorn.

Comparison of Tissue Doses for High Energy Radiation (1–70 mev.). By Carl B. Braestrup.

THE THIRD SYMPOSIUM NEURORADIOLOGICUM

The Third Symposium Neuroradiologicum will be held in Stockholm, Sweden, from September 17 to 20, 1952.

President: Professor Erik Lindgren, Stockholm

Vice-President: Professor Olle Olsson, Lind

Secretary: Docent Åke Lindbom, Stockholm

Main Themes:

Vertebral angiography
Roentgen diagnosis of spinal tumors
Phlebography in neuroradiology

Papers will also be read on various neuroradiological subjects.

Contributors (among others): James Bull, London; Kurt Decker, München; H. Fischgold, Paris; Mario M. Lenzi, Modena; Fermo F. Mascherpa, Milano; D. L. McRae, Montreal; Reginald G. Reid, Manchester; B. G. Ziedses des Plantes, Rotterdam; The Roentgen Department of the University Clinics, Lund; The Roentgen Department of Serafimerlasarettet, Stockholm.

There will be a scientific exhibit, a technical exhibit and a social program.

Radiologists, neurosurgeons and neurologists will be welcome at the Symposium. All those wishing to attend should send in their names and addresses to the Secretary. A detailed program will be published early in 1952 in the same journals as this pre-

liminary notice and also sent to those who have expressed their intention of being present. Arrangements for hotel accommodation in Stockholm will be announced in due course. The social program will include plans for the entertainment of the ladies accompanying members. The subscription fee will be approximately Sw. Kr. 75:– for active member and Sw. Kr. 25:– for companion.

Correspondence should be addressed to Symposium Neuroradiologicum, Serafimerlasarettet, Stockholm K., Sweden.

GRANTS AND FELLOWSHIPS IN RADIOLOGICAL RESEARCH

On behalf of the James Picker Foundation, the National Research Council announces the continued availability of Fellowships and Grants in Radiological Research. The Council has been designated as the administrative and scientific advisory body to the Foundation. Applications are reviewed by the Committee on Radiology of the Council's Division of Medical Sciences. Final determination of awards is made by the Board of Directors of the Foundation upon recommendation of the Committee, and the Council is responsible for administration of funds.

Fellowships in Radiological Research offer research training for recent graduates entering upon investigative careers in the field. Stipends vary from $3,000 to $5,000 per annum, depending on the qualifications and special circumstances of the applicant. Candidates must have the M.D. or Ph.D. degree or equivalent experience and achievement in research. Appointments are not limited to citizens of the United States. Applications for 1952–1953 must be postmarked on or before *December 15, 1951.*

Grants in Radiological Research are designed to encourage research leading to improvement in medical diagnosis and treatment oriented toward radiological methods. The Foundation has specifically requested that none of its funds be used to subsidize the development of radiological equipment. Grants are not restricted to institutions within the United States. Applications for grants for the fiscal year 1952–1953 must be postmarked on or before *January 1, 1952.*

Complete details and application blanks for Fellowships and Grants may be obtained from the Secretary, Division of Medical Sciences, National Research Council, 2101 Constitution Avenue, N. W., Washington 25, D. C.

UROLOGY AWARD

The American Urological Association offers an annual award of $1,000.00 (first prize of $500.00, second prize $300.00 and third prize $200.00) for essays on the result of some clinical or laboratory research in Urology. Competition shall be limited to urologists who have been in such specific practice for not more than five years and to men in training to become urologists.

The first prize essay will appear on the program of the forthcoming meeting of the American Urological Association, to be held at the Chalfonte-Haddon Hall, Atlantic City, New Jersey, June 23–26, 1952.

For full particulars write the Secretary, Dr. Charles H. de T. Shivers, Boardwalk National Arcade Building, Atlantic City, New Jersey. Essays must be in his hands before February 15, 1952.

Committee on Scientific Research
Miley B. Wesson, *Chairman*
John E. Heslin
Harry M. Spence

RICHMOND COUNTY RADIOLOGICAL SOCIETY

On the evening of Thursday, September 20, 1951, the Richmond County Radiological Society was formed with the following members:

Dr. L. P. Holmes, *President;* Dr. H. R. Osherroff, *Vice-President;* Dr. W. F. Hamilton, Jr., *Secretary;* Dr. Stephen W. Brown; Dr. Jack H. Levy; Dr. Irving Range; Dr. S. M. Roberts; Dr. Hoke Wammock. *Associate Members:* Dr. John H. Deaton, Dr. T. F. Jackson and Dr. S. H. Prather.

The first scheduled meeting with a

planned program of a talk and film reading session was held on Wednesday evening, October 3, 1951.

LAURISTON S. TAYLOR APPOINTED CHIEF OF ATOMIC AND RADIATION PHYSICS DIVISION

Lauriston S. Taylor, formerly in charge of the Radiation Laboratory, has been appointed chief of the Atomic and Radiation Physics Division and coordinator of Atomic Energy Commission projects at the National Bureau of Standards. His work will involve the over-all direction of research programs in atomic and nuclear constants, electron physics, mass spectrometry, spectroscopy, radioactivity, roentgen rays, nucleonic instrumentation, high voltage generators and accelerators, and evaluation of radiation hazards.

REPORT OF COMMITTEE OF MINNESOTA STATE RADIOLOGICAL SOCIETY FOR HOSPITAL ADMISSION CHEST EXAMINATION*

Your committee respectfully submits the following report:

I. Hospital admission chest examinations are highly desirable as a public health measure and as a protective measure against the spread of tuberculosis to hospital personnel and other hospital occupants.

II. Members of this Society are urged to promote this procedure in all hospitals with which they are associated and to that end should solicit the aid and cooperation of the individual hospital administrations, the staff of the hospital, and especially the staff most directly concerned with diseases of the chest.

III. Your Committee recognizes that the wide variations in hospitals as to location, size, specialization, financial status, availability of radiological staff and equipment, and availability of adequate space make it impossible to recommend a uniform program for all hospitals. With this in mind, the Committee makes the following recommendations:

(a) The taking and reading of chest films and photofluorograms should be entirely under the jurisdiction of the Roentgen Department of the Hospital. The follow-up work belongs under the supervision of the attending physician.

(b) The taking, processing, reading and reporting of chest films or photofluorograms should be carried out within twenty-four hours of admission of the patient. The follow-up medical staff should receive and review all positive reports before filing and should at once institute necessary follow-up procedures.

(c) Both the roentgenologist and the attending physicians should assume the responsibility that all adult admissions are submitted to the examination.

(d) The lower age limit of patients to be included in the study should be determined by the staff. It is recommended that this age limit should be the 16th birthday, but it may be set at a lower age at the discretion of the staff.

(e) Smaller hospitals, possibly up to 150 or 200 adult bed capacity, could justifiably use 14×17 inch films made in the established Roentgen Department. Since most admissions are in the afternoon and evening hours, this should be feasible without undue delay of the other admission routine. The 14×17 inch film should be treated as a diagnostic study and not only a study for "detection of pathology."

(f) In larger institutions photofluorography would be more feasible and may be highly desirable. The following detailed recommendations are made regarding photofluorography:

1. The photofluorography equipment should be installed in the admitting department. Any compromise with this recommendation will, in direct proportion to the adjustment made, compromise the efficiency and adequacy of the program.
2. The technical staff should consist of members of the technical staff of the Roentgen Department, who may be rotated through the admitting department. Any concessions in this matter likewise will compromise the results.

* Presented to the Society and adopted unanimously at the annual meeting at Rochester, Minnesota, May 1, 1951.

3. The photofluorographic equipment should be the best obtainable with the funds available. The choice of equipment should rest with the radiologist of the hospital concerned.
4. The exposures may be made with or without the removal of the patient's clothing. This should be decided by the individual radiologist who reads the films.
5. The emergency technician of the Roentgen Department should be available for call at all hours so that the service is available on a twenty-four hour basis.
6. All patients not submitted to photofluorography on admission should be examined within twenty-four hours, either by return to the photofluorographic unit, or by 14×17 inch film in the Roentgen Department, or at the bedside.

IV. Your Committee recognizes the fact that such a program of Hospital Admission Chest Examinations, if done correctly, is time-consuming and places a not inconsiderable burden and responsibility on the roentgenologist. The Committee believes the radiologist should be compensated just as any other physician practicing his profession. In this stand the Committee follows the advice of the American College of Radiology (*Monthly News Letter*, Oct., 1949). This position is also supported by a quotation from a letter dated Nov. 1, 1946, of H. V. Hullerman, M.D., Assistant Director of the American Hospital Association, to Dr. E. S. Mariette, as follows: "The National Association has made no recommendation with respect to charges or methods of paying radiologists, recognizing this is a matter of concern to the individual hospital and radiologist. Presumably, the same principle that applies to all radiology service will guide the development of charges and payments in mass radiography programs. These principles are based upon the idea that there should not be exploitation by the hospital, patient, or radiologist, and the procedures should be such as to provide the greatest possible X-ray service consistent with the patient's needs."

We, therefore, make the following recommendations:

(a) A charge labeled "Admission Examination" should be made against every adult admission to the hospital who is so examined.
(b) Such charges should be credited to the accounts of the Roentgen Department.
(c) Where a 14×17 inch film is used for examination, a charge of not less than $4.00 should be made.
(d) Where photofluorographic examination is made, the charge is to be not less than $1.50, the charge to be determined by the individual hospital and its roentgenologist, keeping in mind the total expense of the examination, including remuneration of the roentgenologist.
(e) A follow-up single 14×17 inch film examination should bear the usual charge for this examination in addition to the charge made for photofluorography.
(f) It is assumed that these charges include a sufficient margin above cost of production to provide remuneration for roentgenologic supervision of the program. It is also assumed that the details of the program will have to be determined individually in every hospital by the cooperative effort of the administration and the roentgenologist.

V. Finally, your Committee respectfully submits that emphasis be placed on the quality of the work done, rather than on minimal expense and minimal personal effort.

Committee for Admission Chest Examinations of Minnesota Radiological Society
J. P. Medelman, M.D., *Chairman*
C. B. Nessa, M.D.
Walter H. Ude, M.D.
Stanley C. Peterson, M.D.
A. L. Abraham, M.D.

ABSTRACTS OF RADIOLOGICAL LITERATURE

Department Editor: T. LEUCUTIA, M.D., Harper Hospital, Detroit 1, Michigan

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ROENTGEN DIAGNOSIS

Genitourinary System

Schmidt, C. Robert, Huebert, D. W., and Beazell, James M. Retrocaval ureter. *Arch. Surg.*, Feb., 1951, *62*, 299–302.

Retrocaval ureter is a congenital anomaly resulting in a displacement of the ureter so that it encircles the vena cava on its course to the urinary bladder.

A review of the literature shows 37 cases previously reported. The symptoms caused are those of mild obstruction and recurrent attacks of infection.

Roentgen examination shows a characteristic dilatation of the ureter down to where it crosses medially behind the inferior vena cava.

The ureter was sectioned, brought from its postcaval location, and anastomosed. There was no recurrence of urinary symptoms two years after operation.—*F. H. Squire, M.D.*

Mascio, Aquino. Osservazioni sul dinamismo pielo-ureterale nel tratamento conservativo delle idronefrosi. (Observations on the pyeloureteral dynamics in the conservative treatment of the hydronephrosis.) *Arch. ital. urol.*, 1950, *24*, 83–113.

The author discusses the plastic and fixation procedure of Marion with a personal diagnostic adjunct (study of the pyeloureteral emptying time via nephrostomy tube), before and after treatment with testosterone (500 mg. in twenty days), affirming the beneficial effect of the hormone therapy.

Hormone therapy without surgery in an eight month pregnant woman with uncontrollable symptoms also had a favorable result. No abnormal posthormonal sequelae were noted.—*N. M. Albanese, M.D.*

Camerini, R., and Lurà, A. La stratigrafia associata al pneumorene nello studio dei tumori renali. (Stratigraphy and perirenal air insufflation used in the study of renal tumors.) *Ann. radiol. diag.*, 1950, *22*, 308–318.

The authors advocate the use of this method in the study of renal tumors to overcome the difficulties encountered by superimposed gas shadows of the gastrointestinal tract and overlying soft tissue structures on routine films. They believe that they can more accurately define tumors as being intrarenal or extrarenal, solid or cystic by using this method. Included in the article are 3 case reports. They do not describe what technique was used for the perirenal insufflation.—*P. E. Russo, M.D.*

Paoletti, Mario. La distopia crociata renale. (The crossed ectopic kidney.) *Ann. radiol. diag.*, 1950, *22*, 276–298.

The author reports 2 cases of this very rare anomaly. In the first case, he was able to demonstrate the presence of three kidneys by intravenous and retrograde urograms. A right ectopic kidney was located just below the normal left kidney with its ureter which crossed to the right side and had a ureter opening on the right side of the bladder. A normal right kidney and ureter were also present. In the second case the left kidney was located in the right iliac fossa and apparently fused with the right kidney. The left ureter crossed the pelvis and drained into the left side of the bladder.

In the opinion of the author unless these ectopic kidneys are infected or involved by some other pathological process, they remain asymptomatic.—*P. E. Russo, M.D.*

Berner, Friedrich. Die bösartigen Nierengeschwülste. (The malignant renal tumors.) *Strahlentherapie*, 1950, *83*, 199–230.

Maldevelopment of tissue can arise in many ways during the complicated embryology of the kidneys; thus adenomas, fibromas, and cystic malformations are common. Ectopic development of tissue may result in the presence of renal tissue in the suprarenals, and vice versa. Further, faulty differentiation of tissue may produce islands of tissue foreign to the kidney; *e.g.*, smooth or striated muscle, mucinous, fatty or cartilaginous tissue, and various types of epithelium. *Mixed* tumors therefore develop, and the predominant tissue element of renal tumors is variable. The clinical term "hypernephroma," better yet "hypernephroid tumor," is retained, however, with the full knowledge that the great majority of such tumors are carcinomatous or sarcomatous developments from renal tissue.

Hematuria, pain and palpable mass cannot be relied upon for early diagnosis; the first attack of hematuria may be particularly treacherous in that it usually ceases spontaneously and is then investigated no further. Of even less diagnostic value are changes in the blood picture, sedimentation rate, the appearance of fever, weakness, weight loss, cachexia, and digestive disturbances. Cystoscopy can localize the side from which the bleeding comes and, with studies of dye excretion, establish the functional capacity of the healthy kidney.

The roentgen methods of diagnosis, plain films of the abdomen and excretory and retrograde urography, yield four broad pyelographic groups: (1) a tumor is certainly present; (2) the presence of a tumor is reasonably established; (3) despite the presence of a tumor, the pyelograms are normal; and (4) the affected kidney presents only hydronephrosis. Scheele has combined pyelography with palpation during fluoroscopy to demonstrate that a palpable mass is indeed a renal mass. He lists the manifestations of renal tumor on pyelography as: (1) The kidney is displaced downward, the renal axis is

altered so that it is directed *medially* and downward, and the upper portion of the ureter runs a horizontal course or is angled acutely. (2) The calyces are narrowed or not demonstrated; the infundibula may be stretched over tumor masses and thus considerably elongated. (3) Tumor masses (or blood clots) may protrude into the pelvis to produce filling defects. Metastatic tumor may be demonstrable in the lungs or skeleton. If abnormalities of the kidneys or pelves are bilateral, "considerations of tumor may be abandoned with great safety."

The treatment of choice is radical removal of the affected kidney. Preoperative irradiation is not indicated because if the tumor is considered too large to be treated surgically at the outset, it is practically inoperable so far as radical removal is concerned, even after radiation therapy. Large renal tumors in children are much easier to remove surgically than their size might indicate, so that preoperative irradiation has no place there either.

Postoperative irradiation is recommended when the tumor has been removed, if for no other reason than to increase the "factor of certainty" of a cure. When the tumor cannot be removed in its entirety or when venous tumor thromboses are present, intensive radiation therapy should be begun early—as soon as the stitches have been removed. Radiation therapy is also applicable with benefit to the inoperable tumors and to isolated metastases.

Because of the varied character of the tumorous tissue, different parts of the tumor may vary in sensitivity or resistance to radiation therapy; the same is true for metastases. In the latter case, differences in tumor bed introduce still more variables in radiation response.

Since tumor cells may survive irradiation and again grow, renal malignancies (as also other malignant tumors) should be treated with at least two series of irradiation.

The technique of setting up the fields for treatment is detailed: emphasis is placed on the use of compression, on the need for a posterior bolster to bring the renal area closer to the tube during irradiation of the anterior field, on the desirability of having the posterior field treated with the patient lying on the tube to bring the renal area closer to it, and on the need for including the renal hilus and the regional lymph nodes in the treatment fields. Customarily three 10 by 15 cm. treatment fields (anterior, lateral, and posterior) are used; anterior and posterior oblique fields may be added from the unaffected side.

Eighty-one cases of hypernephroid tumors were treated between 1920 and 1943. This series is dealt with in detail; of the 81 cases, 5 were considered cured; 7 (8.6 per cent) survived five years; 1 (1.2 per cent) survived more than ten years.—*H. G. Moehring, M.D.*

ADAMS, A. WILFRID. A review of nephroma and ten nephrectomies in 1949. *Brit. J. Surg.*, Oct., 1950, *38*, 210–223.

The present ten year survival rate of 20 per cent in adenocarcinoma of the kidney could readily be doubled if all cases were operated upon in an early stage. Because renal neoplasm is not frequently encountered, it is difficult for the physician to stay on the alert for this "uncommon but fell disease in which remedial benefits are in ratio to promptitude of treatment." Therefore, the author relates his experience with 10 cases seen in one year and reviews the subject.

He suggests that the etymologically senseless term "hypernephroma" be replaced by the term "nephroma"; and that the clinical classification of nephromas be reduced to parenchymal adenocarcinoma and calicopelvic epithelioma.

His article centers on the importance of finding promptly the cause of hematuria, the single most frequent symptom of renal neoplasm. Delay in recognition of kidney cancer is usually due to failure of prompt investigation or to incomplete investigation of this symptom. He recommends that, in cases where full study fails to discover the cause of hematuria, urography be repeated at three month intervals for two years before the bleeding is dismissed as idiopathic.

In his discussion of treatment, he comments upon the danger to the opposite kidney from scattered radiation during roentgen therapy of the diseased kidney or kidney bed, citing an instance in which a patient who had received preoperative irradiation died in uremia ten days after nephrectomy.—*George Cooper, Jr., M.D.*

GÜNTHER, G. W. Pyelogramm bei embolischer Totalnekrose der Niere. (Pyelogram in complete embolic necrosis of the kidney.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Oct., 1950, *73*, 619–622.

The author had the opportunity to observe from the onset the course of an embolic blocking of the main renal artery with resulting complete necrosis of the kidney. The patient, a fifty-one year old female, was in the hospital at the time for a cardiac condition. She suffered a sudden intensive pain in the left kidney region. The next day no excretion of the contrast medium was noted cystoscopically from the left urinary tract and intravenous pyelogram also showed no evidence of excretory function of the left kidney. A retrograde pyelogram remained entirely negative. The intensive pain lasted four to five days and completely subsided at the end of fourteen days. No hematuria was noted at any time. The patient died on the thirty-second day from heart failure.

At autopsy, it was found that the left kidney, in spite of the total necrosis, was not appreciably re-

duced in size; it measured 10.5 cm. in length and weighed 130 gm. A red thrombus blocked the main left renal artery.—*Salomon Silvera, M.D.*

Cooke, Robert E., and Kleeman, Charles R. Distal tubular dysfunction with renal calcification. *Yale J. Biol. & Med.*, Dec., 1950, *23*, 199–206.

This is a case report of a six year old boy first seen with a provisional diagnosis of hyperparathyroidism. Roentgenograms showed diffuse calcification in the parenchyma of both kidneys.

In 1940 Albright and his associates reported a case of nephrocalcinosis with rickets and dwarfism in which the diffuse renal calcification was associated with disturbed renal function. This and other studies since have indicated diminished ability of the kidney to exchange hydrogen and ammonium ions for sodium. Metabolic acidosis results from this sodium loss from the body as it is excessive in comparison to the chloride loss. There is also loss of water despite systemic dehydration. Chemically and physiologically these alterations have been localized as functions of distal renal tubules.

The patient reported was studied comprehensively. The administration of parathyroid extract gave values which made it possible to rule out primary hyperparathyroidism. It was concluded by the investigators that the origin of the disturbance was on a congenital basis. For two months after discharge, therapy consisted of daily administration of sodium acetate and improvement in growth was promptly recorded.—*J. W. Turner, M.D.*

Moore, Thomas. Hydrocalicosis. *Brit. J. Urol.*, Dec., 1950, *22*, 304–319.

Dilatation of renal calyces follows obstruction to their urinary outflow. Usually the lesion is lower in the urinary tract and thus the condition is part of a hydronephrosis. Less frequently local obstruction may occur in a calyx itself. The cause is commonly a stone or post-inflammatory fibrosis. In this paper, only those interesting cases are considered in which usually one but sometimes more than one calyx becomes dilated in the absence of any obvious mechanical cause. The author believes all are dilated calyces caused by achalasia of one or more of the calyceal sphincters, and should all therefore be described as examples of hydrocalicosis.

The subdivision of a major calyx does not only take place at its end; minor calyces may arise from it anywhere along its length. Nor are these calyces all in the same plane; they may pass in any direction in the kidney. In some kidneys many of the minor calyces, particularly those originating from the wall of a calyx near but not at its termination, are very small indeed. Sometimes a small calyx arises from the fornix of a minor calyx. It is not infrequent for a major calyx to remain single and without minor calyces. Dissections have also shown that it is common for a calyx to drain the anterior, or more usually the posterior, part of the middle of the kidney, into the pelvis medial to the sites of origin of the primary calyces. These anatomical facts are of great importance in comprehending the many varieties of cysts which may arise from dilated calyces.

There is a very definite system of sphincters. As it is the failure of one or more of these sphincters to relax, which is the underlying basis of hydrocalicosis, it is necessary that they should have names for the purpose of identification. It is proposed to call the sphincter in the calyx just below the apex of the papilla "the sphincter of the calyceal fornix," that at the junction of minor and major calyx "the minor calyx sphincter," and that where the major calyx joins the pelvis "the major calyx sphincter."

Clinical examination is rarely of much help in the diagnosis, which depends on careful intravenous and retrograde urography. This will demonstrate the dilated calyx and its slow emptying. It is very important to take roentgenograms in the oblique and lateral views, so that the dilated calyx is seen clear of neighboring calyces and its exact relationship to and communication with adjacent calyces is demonstrated. Without this precaution one can easily be deceived by ordinary anteroposterior urograms. Stones lying in a hydrocalyx may be shown to occupy slightly different positions in the erect and supine views in a straight roentgenogram.—*E. J. McDonald, M.D.*

Engel, William J. Nephrocalcinosis. *J.A.M.A.*, Feb. 3, 1951, *145*, 288–294.

The author reports 7 cases with bilateral diffuse calcifications in the renal parenchyma, generally in the pyramids and demonstrable by roentgen examination. The age incidence varied from four months to sixty years, 2 cases being children and 5 adults. In addition to the nephrocalcinosis, 5 patients either had stones or gave a history of passing stones.

The findings in these cases are in keeping with Albright's conception that this condition is of renal origin and is the result of damage and dysfunction of the distal convoluted tubules. It is believed that calcification is secondary to the tubular damage. It may extend down into the collecting tubules and small masses may coalesce to form concretions. There would be a natural tendency for these to be expelled into the renal pelvis.

There is abundant evidence to indicate the role of the sulfonamides in producing direct toxic action on the distal tubules. It may be more than coincidental that, following the introduction of sulfonamide therapy, such cases seem to be more frequent. However, it should not be inferred that all cases of nephrocalcinosis are due to sulfonamide intoxication.

Treatment of this condition is designed to relieve the acidosis, reduce the hyperchloremia and correct

the negative calcium balance. The polydipsia and resulting polyuria are due to the inability of the kidneys to concentrate urine and they cannot be corrected.—*A. E. Childe, M.D.*

NERVOUS SYSTEM

LINDBLOM, K. Technique and results in myelography and disc puncture. *Acta radiol.*, Oct.–Nov., 1950, *34*, 321–330.

Following a short description of the technique of myelography with a water-soluble contrast medium in which its limitations are pointed out, a description of the procedure of disc puncture is given. A double needle is used. The outer one is inserted into the spinal canal and the inner into the disc. The puncture is controlled by fluoroscopy. One-half to 2.0 cc. of a contrast medium of the perabrodil type (umbradil), mixed with novocain, is injected.

Only 2 of 52 punctured discs in the living material showed normal spread of the contrast medium. The other 50 discs were more or less ruptured with spread of the medium into the ruptures, into the whole space of the destroyed disc, and into the adjacent structures, mostly epidurally. Epidurally, the usual spread was along the affected roots or else the dye formed a deposit around the prolapse. Infrequently the spread was more diffuse without definite structures being distinguishable. In 4 patients a disc was found with rupture toward the outside of an intervertebral foramen. Sciatic pains were reproduced by the injection in these cases.

As a rule, disc ruptures and protrusions are diagnosed clinically and therefore myelography and disc puncture are not usually needed in making the diagnosis. These procedures should be saved for the purpose of preoperative localization.

It must be remembered that many disc cases heal without operation. The granulation tissue on the surface of a ruptured disc may absorb. This has been demonstrated in autopsy specimens as well as in the curettage fragments obtained at operation. The fact that there is a healing factor which can take place in these cases must be borne in mind before the patient is subjected to methods used in localization and to surgery.—*Mary Frances Vastine, M.D.*

WOODHALL, BARNES, and HAYES, GEORGE J. The well-leg raising test of Fajersztajn in the diagnosis of ruptured lumbar intervertebral disc. *J. Bone & Joint Surg.*, Oct., 1950, *32-A*, 786–792.

The authors review the early history of the Lasègue sign and give credit to Fajersztajn for the first demonstration of the crossed or well-leg-raising test. In Fajersztajn's paper is found the first mention of the so-called crossed-sciatic phenomenon, or the elicitation of pain in the affected hip and limb by the performance of the straight-leg raising test on the healthy extremity. The authors, in their summary, state that numerous observers have shown that flexion of the thigh on the abdomen with the leg extended causes rostral movement of the contralateral extradural nerve roots at the fourth and fifth lumbar and first sacral levels, with approximation of these nerve roots to the anterior spine wall. These findings have been confirmed. It has been shown that approximately one-third of all patients with verified disc protrusions have a positive well-leg raising test, and that almost all of these have large protrusions. In the cases in which this relationship has been studied, the disc protrusion has been found on the medial aspect of the affected nerve root.—*R. S. Bromer, M.D.*

UTHGENANNT, HERMANN. Die Bedeutung der Abrodil-Myelographie in der Ischiasdiagnostik. (The significance of abrodil myelography in the diagnosis of sciatica.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Dec., 1950, *73*, 726–735.

The author uses abrodil, which is water soluble, because he obtains better detail, and does not have the medium break up into droplets. A spinal anesthesia is a preliminary to the instillation of the abrodil to prevent the pain which it would otherwise produce.

He classifies his disc herniations into three groups of lateral, and one group of medial. His first group of lateral herniations are of moderate size, and under tension, so that, when incised, more material is extruded into the spinal canal. The second group, usually of longer duration, and larger, are no longer under tension, and may consist of masses of material nearly free in the canal. The third are the very small ones, with a short history, and are of importance because they are the ones which most frequently recur following operation.—*J. J. B. Light, M.D.*

TUCKER, JAMES T., and CARPENTER, EARNEST B. Localized neurofibromatosis with associated overgrowth of an extremity; equalization of limb length following epiphyseal arrest. *J. Bone & Joint Surg.*, Jan., 1951, *33-A*, 103–106.

The authors report a case of the unusual occurrence of a localized neurofibroma which apparently started to grow rapidly several months after relatively minor trauma. There was marked overgrowth of the affected limb in a year. Evidence of generalized neurofibromatosis was not present in the patient and there was no history of such a lesion in the family. Epiphyseal arrest of the distal femoral and proximal tibial epiphysis was performed, and measurement of the affected leg seventeen months after operation showed the difference in leg lengths of only

¼ inch, compared with a difference of 1½ inches before operation.—*R. S. Bromer, M.D.*

Selby, S. Neuroblastoma of extrarenal origin. *Arch. Dis. Childhood.*, Dec., 1950, *25*, 411–415.

Malignancy in a Bantu child is unusual. In 7,500 admissions on the Pediatric Service of the Coronation Hospital, Johannesburg, only 4 cases of embryoma of the kidney, 2 cases of reticulum cell sarcoma and this 1 case of neuroblastoma have been seen.

A five year old female Bantu child was admitted with swollen feet, diarrhea night and day, and bloody urine. The temperature was 102.6° F. The patient was anemic, had puffy eyelids, enlarged liver and spleen and a non-tender mass in the umbilical area.

During observation epistaxis was frequent. The left eye became more swollen and prominent. Three local edematous areas appeared on the skull. Roentgenograms showed widespread neoplastic changes in the skull, femora and tibiae. The skull increased in size and showed evidence of increased intracranial pressure. Pleural thickening appeared in the chest. The veins in the neck became distended and the patient developed marked dyspnea. Roentgen therapy was given over the skull and abdomen but was discontinued due to rapid deterioration.

Necropsy: Body emaciated. Head grossly enlarged with obvious lumps in parietal and occipital areas. Pleural and peritoneal cavities contained blood-stained fluid. All ribs were involved by metastatic growth. The liver was markedly enlarged by multiple metastatic nodules. An abdominal mass adherent to lumbar spine had two lateral masses attached to it that proved to be ovaries. Ureters were compressed; adrenals were thin. Kidneys were large but normal. The scalp showed numerous hemorrhagic areas and the tables of the skull were riddled with metastases.

The unusual radiosensitivity of this tumor is illustrated by comparison between treated and untreated areas.

The origin of the lesion was not determined, both kidneys appearing normal.—*G. H. Ramsey, M.D.*

Perey, Olof. Contrast medium examination of the intervertebral discs of the lower lumbar spine. *Acta orthop. Scandinav.*, 1951, *20*, 327–334.

In a brief confirmation of Lindblom's work (see above abstract), Perey reports his experience with discography in 35 patients.

There were no complications during the examinations. Five patients had headache afterwards, 1 had attacks of vomiting, 2 had a moderate amount of fever. One patient had fever for six days, all others were free of after effects in three days. The after effects all occurred in patients who had been punctured with a lumbar needle. In the one punctured with a double needle, after effects were not observed.

Eighteen of the 35 patients had air myelography as well as discography. In 6 of the 18, a prolapse was found at operation which had not been demonstrated by air myelography but had been diagnosed by discography. In 1 instance, the reverse was true.

Twenty of the 35 patients were operated upon. In 17, the roentgen diagnosis agreed with the operative findings. In 1, a prolapse was found which was not demonstrated by discography. In 2, a rupture through which the contrast medium diffused into the extradural space was shown by discography, but no prolapse was found at operation.—*George Cooper, Jr., M.D.*

Knutsson, Folke. Lumbar myelography with water-soluble contrast in cases of disc prolapse. *Acta orthop. Scandinav.*, 1951, *20*, 294–302.

Knutsson reports on his use of abrodil (ICH_2SO_3Na), a water-soluble contrast medium, in over 900 lumbar myelographies.

With the head of the roentgenographic table elevated enough to keep the water-soluble material at the lumbar end of the canal, the patient lies on the affected side with the waist supported by pads to keep the spine straight. Abrodil is irritating and causes sufficient pain to require anesthesia. After lumbar puncture, 1 ml. 5 per cent solution of procaine is injected into the canal, ephedrine being given prophylactically to avoid a fall in blood pressure, and ten minutes later from 8 to 10 ml. of 20 per cent abrodil is injected slowly. The material is absorbed slowly so that roentgenographic studies can be carried out leisurely. It gradually diffuses through the cerebrospinal fluid and is absorbed. The author recommends that the patient be kept horizontally in bed for twenty-four hours after examination.

As to complications, he gives no figures, but he has apparently encountered mild headaches and nausea rather frequently. Of real concern is his statement that some of his patients, "two to three hours after examination, have suffered from shock with short periods of unconsciousness and epileptiform cramps. As a rule this has passed over quickly."

The illustrated reproductions of roentgenograms show a much more complete, detailed visualization of the lumbar canal and root sheaths than is usually obtained with either oil or air.—*George Cooper, Jr., M.D.*

Skeletal System

Fuiks, Dellivan M., and Grayson, Charles E. Vacuum pneumoarthrography and the spontaneous occurrence of gas in the joint spaces. *J. Bone & Joint Surg.*, Oct., 1950, *32-A*, 933–938.

The occurrence of gas in joint spaces is not un-

usual and is generally considered of little or no significance. The production of low pressure in the joint by traction releases gas from the adjacent tissues into space, which is thus visible by contrast roentgenographically. Sufficient amounts have been produced by decompression, as in "bends" for quantitative analysis. The gas is a mixture of oxygen, carbon dioxide and nitrogen, in proportion similar to that of the circulating fluid.

The authors' observations include 4 instances in which the medial joint space was visible with the knee extended and the muscles relaxed. In 1 of these badly frayed meniscus was evident by vacuum technique, 2 had numerous loose bodies, and 1 showed deformity of the cartilage associated with hypertrophic arthritis. The same abnormality has been observed in 16 knees examined with the patient in the kneeling position.

Forced abduction or adduction of the knee joint for diagnostic purposes is of limited value, but the expediency and simplicity of the procedure, the authors believe, warrant its use. They have seen a thin gas line in 4 sacroiliac joints and they believe there is presumptive evidence that this is the same phenomenon which occurs in other joints.

The following conclusions are reached: (1) Absence of the vacuum space indicates fluid which may not be detected otherwise. (2) The meniscus can be demonstrated in the absence of fluid. Neither weakening nor relaxation of the ligaments is a prerequisite. (3) Visualization is limited to the rigid structures and does not include synovial extensions or fat pads, as does the injection technique. (5) The examination can be done simply, quickly, and without the use of surgical technique or apparatus. Spontaneous vacuum phenomena occur only in abnormal hip joints and demonstrate irregularities of the cartilage which would otherwise not be perceptible by roentgenographic examination.—*R. S. Bromer, M.D.*

Steindler, Arthur. Pyogenic arthritis. *Bull. New York Acad. Med.*, Feb., 1951, *27*, 101–123.

The author reports on 326 cases of pyogenic arthritis. The usual infectious agents are *Staphylococcus aureus; Streptococcus haemolyticus;* the pneumococcus; *Brucella;* and the gonococcus. These produce similar pathological courses, varying in acuteness of progression and severity. Roentgen evidence develops slowly unless there is an extension of an osteomyelitis to involve the joint. Capsular distention is the first sign, followed by joint narrowing with cartilaginous destruction, bone destruction, dislocations, and an ankylosis or repair with no permanent deformity.

Treatment consists of adequate drainage, immobilization by traction or plaster, correction of faulty positions, general supportive measures, and antibiotics.

A number of case reports illustrate the various types of infections, the various stages of pathology, and the complications encountered.—*F. H. Squire, M.D.*

Barmeyer, George H., Alderson, Lee R., and Cox, Walter B. Traumatic periostitis in young children. *J. Pediat.*, Feb., 1951, *38*, 184–190.

The authors believe that a traumatic periostitis is the cause of many cases of so-called "acute limping leg" in childhood. The injury is usually a minor one with no direct truama involved. Subsequent to the injury the child cries when the leg is palpated and refuses to bear any weight on the affected limb. Roentgenograms at the time reveal no evidence of fracture. Recovery is usually rapid. Roentgenograms taken ten days to two weeks after injury will show periosteal reaction.

The pathological change is apparently a small subperiosteal hemorrhage with subsequent organization of the hemorrhage similar to cephalhematoma.

In the differential diagnosis congenital dislocation of the hip, Perthes' disease, poliomyelitis, vitamin deficiencies, and cortical hyperostosis must be considered. Acute osteomyelitis, fatigue fracture, hypertrophic pulmonary osteoarthropathy, and progressive diaphyseal dysplasia are more unusual conditions which might simulate the same roentgen appearance.

The authors cite 7 case reports including illustrative roentgenograms. There is no treatment required.—*R. M. Harvey, M.D.*

Smith, Jarvis M. Adolescent deficiency disease; report of a case. *J. Bone & Joint Surg.*, Jan., 1951, *33-A*, 230–234.

The case reported is that of a white girl, aged thirteen, whose roentgenograms revealed widening in the metaphyseal regions of the long bones and a wide proliferating zone immediately beyond the cartilage plate. The blood chemistry findings were considered to be in line with a rachitic or rachitoid state. Henry L. Jaffe, in his report, felt that renal disease (renal rickets), primary hyperparathyroidism, and by the history, primary idiopathic steatorrhea could be eliminated. He felt that the question of diagnosis narrowed down to whether the patient had rickets caused by vitamin D deficiency or endogenous rickets. The disease picture as a whole tended to favor the latter, but the inorganic phosphorus, although low, was not strikingly so. He also suggested the possibility of failure of absorption of vitamin D from the gastrointestinal tract. With this thought in mind, the patient was started on an intramuscular dose totaling 3,100,000 units of vitamin D per week as well as other vitamins, calcium pantothenate and mixed tocopherols. Improvement occurred with the

patient becoming symptom free. Roentgen examinations showed calcification of the rarefied bands in the metaphyseal areas and increased calcific density of the bones.—*R. S. Bromer, M.D.*

Dickson, Alvis B., Ayres, William W., Mason, Malcolm W., and Miller, Walter R. Lipoma of bone of intra-osseous origin. *J. Bone & Joint Surg.*, Jan., 1951, *33-A*, 257–259.

In a search of the literature, the authors found only 2 previously reported cases of true lipoma of bone of intra-osseous origin. Their case showed involvement of the left tibia. The patient was a white male, aged thirty, who had had pain in the region of the left ankle since the age of sixteen. Roentgenograms revealed a large, oval, cystic area, approximately 8 by 5 cm. in size, situated in the distal end of the left tibia, extending from the epiphyseal line upward. There were coarse trabeculations in some portions of the lesion and a slight expansion of the shaft in the affected area. The general appearance was that of a solitary area of fibrous dysplasia, simple bone cyst or giant cell tumor. A complete survey of the skeleton revealed no other osseous lesion.

Histological sections following operation showed large amounts of mature fatty tissue in which there were sparse trabeculae of bone. The fatty tissue was supported by delicate strands of connective tissue containing capillaries. There was no hemopoiesis. The lipoma was similar to those occurring in subcutaneous tissue except for the bone trabeculae.

Although intra-osseous lipoma of long bones is rare, lipomas occurring in flat bones, particularly of the vertebrae, are not infrequent. When occurring in flat bones, there may be hemangiomatous elements within the fatty tumor.—*R. S. Bromer, M.D.*

Moberg, Erik. The natural course of osteoid osteoma. *J. Bone & Joint Surg.*, Jan., 1951, *33-A*, 166–170.

The localized benign disease of the skeletal system, made known by Jaffe as osteoid osteoma, is now generally accepted as an entity. Its true nature and cause, as well as its natural course, are unknown. The differential diagnosis has likewise been incompletely investigated, according to the author. In his summary he states that, as shown by means of histopathologically verified cases, the small central nidus in the development of the disease process may increase through further destruction until it is larger than the cross section of the normal skeleton at a given point. Two clinically and roentgenographically typical, but histopathologically unverified, cases give presumptive grounds for concluding that the natural course of the disease leads to spontaneous healing. This development appears contradictory to the claim that the disease is caused by bone infarction, and is hardly compatible with the generally accepted definition of a tumor.—*R. S. Bromer, M.D.*

Lichtenstein, Louis. Giant-cell tumor of bone; current status of problems in diagnosis and treatment. *J. Bone & Joint Surg.*, Jan., 1951, *33-A*, 143–150.

Lichtenstein states that uncertainty still prevails in many quarters as to what should be regarded as giant cell tumor of bone (stripped of its spurious variants). This has had the effect of vitiating most of the contributions to the literature of the past ten years. This confusion, he believes, must be dispelled before reports in regard to the efficacy of treatment by one method or another are to have much significance. Some of the pertinent advances of the past ten years have not as yet been fully assimilated.

In 1940, Jaffe, Lichtenstein and Portis attempted to define what properly should be regarded as genuine giant cell tumor of bone, as a basis for more accurate diagnosis and rational therapy. The lesion was interpreted as a distinctive neoplasm arising apparently from the (non-bone-forming) supporting connective tissue of the marrow. Specifically it was stated that the tumor was composed of a vascularized network of spindle-shaped or ovoid stromal cells, regularly and rather heavily interspersed with multinuclear cells (apparently syncytial stromal cells) as an integral part of the cytological pattern. As an important corollary of this study it became evident that genuine giant cell tumor should be completely divorced from its spurious "variants" with which it had been, and to some extent is still, confused.

As a result of subsequent detailed investigation of these alleged variants of giant cell tumor, there evolved a clearer concept of these lesions as distinct clinical and pathological entities in their own right. The so-called spindle cell or healing or xanthic variant was superseded by the rather common lesions now called non-osteogenic fibroma of bone. The "calcifying or chondromatous giant-cell tumor" was reinterpreted and designated benign chondroblastoma of bone in the belief that it represents an independent benign tumor of cartilage-forming connective-tissue derivation, which is unrelated histogenetically to giant cell tumor. The rather common pathological entity frequently mistaken for giant cell tumor and referred to generally as "atypical subperiosteal giant-cell tumors in unusual locations" has been clearly designated under the designation of aneurysmal bone cyst. The observations of Jaffe, Lichtenstein and Portis led them to believe that genuine giant cell tumor, in contrast to some of the alleged variant lesions, is seldom observed below the age of twenty and that, when situated in a long bone, it usually involves the end of the bone. If the giant cell tumor, defined as outlined by Lichtenstein, is stripped of all its alleged variants, then what is left constitutes a formidable neoplasm to be reckoned

with under any circumstances. He believes that it has become increasingly evident that, while giant cell tumors are not necessarily "sarcomata," neither are they all "benign" and that, with respect to potential seriousness, they may run the whole gamut from one extreme to the other.

In regard to therapy of giant cell tumor, the author discusses some of the specific problems entailed in its treatment. He advocates biopsy which should be resorted to before treatment is instituted, irrespective of the method of treatment employed. Whenever it is possible to excise or resect the tumor in toto, this should be the method selected as the most certain and quickest way to effect a cure. Unfortunately, the majority of giant cell tumors present as relatively large growths in the lower end of the femur or the upper end of the tibia, where resection as a routine procedure is hardly feasible. For these, thorough curettement is the procedure generally followed by those committed to surgery. Lichtenstein asks, what proof is there of the validity of the statement "irradiation as an adjuvant to curettage may apparently stimulate recurrence or increase the aggressiveness of the lesion"? If the suggested hazard is real, does it apply to small or moderate, as well as large, doses of roentgen ray? Another suggested approach about which one must keep an open mind is the use of limited roentgen irradiation prior to curettement as advocated by Haggert and Hare. These authors claimed that such preliminary irradiation, adequate to arrest tumor growth temporarily, yet not intense enough to induce bone necrosis or prevent soft tissue healing, renders the tumor tissue sufficiently firm and avascular to permit thorough curettement.

Lichtenstein states that, to his knowledge, a well controlled and altogether convincing sizable series of giant cell tumors treated by roentgen therapy and followed for five to ten years has yet to be presented. No unanimity of opinion seems to exist among the exponents of roentgen therapy in regard to the optimum tumor dose that should be employed or the manner in which it should be administered. He has personal knowledge of several cases in which sarcoma developed within an irradiated and ostensibly cured giant cell tumor after a long latent interval. Such cases are not common in relation to the total number irradiated but they are sufficiently numerous to indicate that bone lesions cannot be irradiated with very large doses of roentgen rays with impunity. The practical importance, according to Lichtenstein, is that, if one elects to irradiate a giant cell tumor, one should use the smallest possible effective tumor dose, that is if 1,000 r will suffice, one should avoid using 3,000 r or more.

The effective control of a giant cell tumor which has already recurred locally following treatment, whether by curettement or irradiation, raises still another set of problems that require clarification. It may be true that roentgen therapy for a tumor which has recurred following curettement is not so effective as one might wish but are the failures necessarily attributable to combined treatment? May they not indicate merely that irradiation is not nearly so effective against the aggressive giant cell tumor of Grade 2 as it is against the more favorable tumors of Grade 1? Before categorically condemning combined therapy, Lichtenstein believes that, in all fairness, one must compare the follow-up results with those in which re-curettement has been employed for recurrence.

In dealing with a giant cell tumor which has recurred more than once, the author is firmly of the opinion that ablation should be resorted to, if the tumor is in a surgically accessible site, since to further temporize is to invite frank malignant change and pulmonary metastasis. It would be entirely feasible to conduct a well planned and controlled, large-scale clinical experiment bearing on the relative efficacy of surgical treatment, roentgen irradiation or both combined. Thus, if the comparative end results of each method were known, in 50 or more proved cases of giant cell tumor, one would have a sound foundation for specific recommendations for treatment. This approach would also yield much information of fundamental importance concerning the biological behavior of giant cell tumor.—*R. S. Bromer, M.D.*

GUZMÁN, LEONARDO. Tumores malignos primitivos de los huesos. (Primary malignant tumors of bones.) *Cancer*, Santiago, Chile, 1950, *7*, 140–171.

This is an excellent article dealing with the primary malignant tumors of bone, based on a personal study of 100 cases treated at the Instituto Nacional del Radium of Santiago, Chile, and an exhaustive review of the world literature comprising over 60 sources of reference.

Classification. After a brief consideration of the various concepts on the histogenesis of normal bone tissue, including that of Ossandón, pathologist of the aforementioned institute, the author enters into a very detailed discussion of the classification of primary malignant bone tumors as proposed by the Bone Sarcoma Registry of the American College of Surgeons. In 60 cases of his own series a biopsy was secured, and the histopathologic findings were coordinated to fit this classification. Typical examples are described in the text and illustrated with reproductions of roentgenograms and photomicrographs. He also mentions briefly other classifications, among them that of Brachetto Brian which was presented at the National Congress of Surgery of Argentina in 1938 and which originally had 32 subdivisions but has been considerably modified since then.

The author feels that for practical purposes a simpler classification based on histopathologic, clinical and roentgenologic criteria would be more desir-

able. He therefore proposes the following classification of the primary malignant neoplasms of bone:

		Roentgenographic appearance
1. Osteogenic sarcoma	osteoblastic	increased density with bone formation
	osteolytic	translucency due to bone destruction with areas of increased density in some cases; without areas of increased density in the pure fibrosarcoma
2. Myeloma, reticulo-endothelial lymphosarcoma and other types composed of anaphastic cells which invade and destroy the bone		osseous destruction without trabeculae or areas of new bone formation
3. Ewing's tumor		linear osseous destruction extending in the direction of the long axis of the bone, alternating with zones of increased density due to condensation of the bone and compression of the trabeculae, with periosteal bone new formation, especially in the diaphysis
4. Osteoclastoma (malignant variant of giant cell tumor)		marked destruction with formation of thin walls giving a more or less spherical honey-combed appearance

Etiology. In the author's series of 100 cases a history of previous trauma was present in 14 instances. In 2 of these the trauma was so violent that fracture resulted. In studying more closely the role of trauma in the causation of osteogenic sarcoma, the impression was gained that 4 patients represented undoubted examples of such relationship. Their case reports are given in brief résumés.

Other possible causes of osteogenic sarcoma are malignant transformation in Paget's disease, myositis ossificans, and especially in chronic osteitis produced by over-irradiation with external roentgen rays or internal irradiation with radium and more recently with certain radioactive isotopes.

Diagnosis. In discussing the diagnosis the author reviews the significance of the various clinical symptoms and lays emphasis on the early appearance of pain, especially in the adolescent period. Roentgenograms in various views are essential and a biopsy should be secured whenever possible.

Results. Of the 60 patients verified histopathologically 25 are alive: 9 less than three years, 9 between three and five years and 7 for a period of five years or longer. Of these, 8 were treated by surgery alone, 6 by roentgen therapy alone and 11 by a combination of surgery and roentgen therapy.

Treatment. The author analyzes at some length the value of the various therapeutic procedures presently used, including surgery, external irradiation with roentgen rays, internal irradiation with radioactive isotopes, administration of Coley's toxins and chemotherapy with nitrogen mustards or stilbamidine.

The conclusion is reached that the confusion which existed and still exists concerning the nature of the various types of primary malignant neoplasms of bone accounts for the poor results obtained. With better knowledge, a definite improvement may be expected. That the bone sarcoma does not always represent a hopeless condition is amply proved by the above cited statistical compilation.—*T. Leucutia, M.D.*

Seyss, Rüdiger. Zur Röntgenologie der Dysostosis multiplex Pfaundler-Hurler. (The roentgenology of dysostosis multiplex [Pfaundler-Hurler's syndrome].) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Dec., 1950, *73*, 749–753.

This is a case presentation of dysostosis multiplex in a six year old boy studied clinically and roentgenologically. The parents were normal, a brother, deceased, had been similar in appearance, a sister was normal. When seen, speech was delayed, bowel and bladder control lacking. The patient was shorter than normal but overweight. The facies was characteristic, with a prominent forehead, hyperteleorism, sunken nose, advanced hairline, sparsely spaced teeth, hepatomegaly, splenomegaly, slight bowing of the extremities, short fingers with hour-glass deformities of the nails.

Roentgenologically, the frontal region of the skull was prominent, the coronal suture open, the lambdoid closed. The sella was small, the maxillae underdeveloped, the mandible prominent. The vertebral bodies were elliptical, the ribs articulated at right angles with the spine and were spatula like. The ischia were small, the acetabula normal, the femoral necks presented some varus deformity. The distal femoral shaft was cupped, the capital epiphysis overlapped the neck, the epiphyseal line was ragged. The head of the humerus was large and the shaft massive. The glenoid cavity was flat. The bones of the hand were somewhat conical, the carpal epiphyses were present but small.

The chief findings were gargoylism, hepatomegaly, and the skeletal changes. This syndrome was first described in 1916 by Hunter and later by Hurler in 1919. About 130 cases have been reported. This is a metabolic disease recognized as a disturbance of lipoid metabolism with abnormal storage in the various organs. Schmidt describes the bone pathology as an irregularity of epiphyseal cartilage proliferation with inequality of epiphyseal bone development and periosteal bone production. The differential diagnosis includes cretinism, Morquio's disease, idiocy both mongolian and amaurotic, chondrodystrophies, Léri's plenostosis, rickets, Englemann's disease, leukemia and sepsis.—*L. A. Nash, M.D.*

Alfred, Karl S., and Harbin, Maxwell. Blastomycosis of bone; report of a case. *J. Bone & Joint Surg.*, Oct., 1950, *32-A*, 887–892.

Mycotic infection of bone must be seriously considered in those cases of infection which do not lend themselves to ready diagnosis. Of the various fungus

infections which may involve bone, the two diseases termed blastomycosis and coccidioidomycosis are by far the most prominent and the most serious. The case presented is that of a white woman, aged twenty-seven, who at the beginning of her illness had a painful lump in her left hip. At the time she came under the authors' care she had progression of the lesion, despite heroic and expensive measures. She had been bedridden for almost two years, had undergone two extensive operations of an exploratory nature and had been subjected to all forms of chemotherapy. She had multiple draining sinuses of the left buttock and thigh with deep postoperative scars with also a mass in the left vulva, resembling a Bartholin cyst, and a glandular breakdown in the left groin with suppuration. Roentgen examination revealed an irregular, 4 cm. hole in the posterior portion of the left innominate bone, just above the sacroiliac joint. The margins of the bone were sharp and there was practically no osteoporosis of the surrounding bone. A similar area of destruction of bone, with no surrounding reaction, was seen in the left ischial tuberosity. Smears of the glandular breakdown in the groin showed numerous yeast-like cells of different sizes with a double-contoured refractile wall, which the authors determined were the typical organism of blastomycosis. Biopsy from the ulcer in the groin substantiated this diagnosis and, in addition, a culture obtained at the time of admission and planted on Sabouraud's medium resulted in a profuse growth of hyphae-like mold characteristic of blastomycosis and coccidioidomycosis. She was treated with vaccines of blastomycosis and coccidioidomycosis, iodides, and deep roentgen therapy. Fourteen months after her admission there was still profuse drainage and she was receiving a second course of deep roentgen therapy.

The authors discuss the pathogenesis, symptomatology, pathological changes, diagnosis, prognosis and treatment. They state there have been favorable reports of the use of deep roentgen therapy of cutaneous and well localized lesions and regard this as well worth a trial in some cases. Roentgenographically the bone lesions of blastomycosis and coccidioidomycosis are identical and cannot be distinguished. The lesions usually arise in cancellous bone and are predominantly destructive, with little or no periostitis, bone production or marginal reaction. Tuberculosis, metastases, myeloma, syphilis, sarcoma, and bone cyst may give somewhat similar roentgenographic findings of which those of tuberculosis are the most confusing.—*R. S. Bromer, M.D.*

HAMBURG, ALLEN E. Skeletal changes in sickle-cell anaemia; report of an unusual case. *J. Bone & Joint Surg.*, Oct., 1950, *32-A*, 893–900.

This paper contains a review of the literature dealing with skeletal changes in sickle-cell anemia and, in addition, a case is reported which presented a diagnostic problem. Sickle-cell anemia is to be distinguished from the sickle-cell trait unaccompanied by anemia. The chronic hemolytic anemia is transmitted as a mendelian dominant characteristic, which occurs almost exclusively in the Negro. In sickle-cell anemia, as in erythroblastic anemia and chronic hemolytic jaundice, abnormal erythrocytes are generated by the blood-forming tissues. Characterized by periods of exacerbation and quiescence, the disease typically presents anemia, leg ulcers, abdominal and joint pains, splenomegaly, apical systolic murmurs, fever, and leukocytosis in children. Usually a diagnosis is easily made, and can be confirmed by examination for the sickle-cell trait in a specially prepared blood smear. The widespread changes found in the various organs of the disease are due to thromboses which form from the rigid sickle cells in the capillaries and rapidly ascend to larger vessels, particularly on the arterial side. It is now postulated that a crisis occurs, due to widespread thrombosis, as the capillaries become jammed with deficiently oxygenated sickle cells. As a result, widespread symptoms become manifest.

The effort of the hematopoietic tissues to maintain adequate circulating blood elements is reflected in the bone marrow, where normal resting yellow marrow is converted into highly cellular, congested red marrow. This hyperplasia may occur in virtually any bed of cancellous bone, but is more marked in the calvarium, the long bones and the bones of the trunk. There are, in addition, varying degrees of thrombosis and infarction, which in time result in hyalinization, fibrosis, abnormal calcification and new-bone formation.

Correlation of the changes reported in the literature shows that roentgenograms of children with the disease have only infrequently demonstrable changes in the long bones, but more often show changes in the skull. The nonspecific changes of osteoporosis, bone widening, and cortex narrowing are found in young patients. In the adult, although the roentgenograms may be entirely negative, the changes when present, reflect long-standing marrow hyperplasia and infarction which produce osteosclerosis with new-bone formation, thickening of the cortex and impingement on the medullary cavity. The degree of the changes can be roughly correlated with the duration and the severity of the disease. The disease cannot be diagnosed from the roentgenogram alone, for the suspected lesions often are not verified by other laboratory studies.

In the patient reported in the paper, a Negro, male, aged fifty-five, the changes in the bones involved the pelvis and the bones of the shoulders, thorax, hands and feet. In the right hip joint there were extensive changes consisting of osteosclerosis, diffuse and localized splotchy areas of radiolucency, inward thickening of the femoral cortex with narrowing of the medullary cavity, confused trabecular

pattern, upward migration of the acetabular cavity and deforming arthritis. From a roentgenographic standpoint, syphilis, tuberculosis, Perthes' disease, osteomyelitis, metastatic carcinoma, Paget's disease, caisson disease, and sickle-cell anemia were all considered in the differential diagnosis.—*R. S. Bromer, M.D.*

Coughlin, Edward J., Jr., Guare, Howard T., and Moskovitz, Abraham J. Chondrodystrophia calcificans congenita; case report with autopsy findings. *J. Bone & Joint Surg.*, Oct., 1950, *32-A*, 938–942.

Occurrence of cases of chondrodystrophia calcificans congenita is still rare enough, in the authors' opinion, to warrant report of individual cases. The case reported had, in addition to stippled and greatly enlarged epiphyses, abnormally short femora and humeri. This would suggest a definite relationship between the condition and the more common types of achondroplasia and chondrodystrophy. The laboratory studies in their case were of little significance except for a slightly elevated alkaline phosphatase. The microscopic studies suggested that the condition was closely allied to the general group of achondroplasia and chondrodystrophy.

The presence of associated congenital defects is of interest. A careful history should be obtained regarding the presence of exanthemas during the early months of pregnancy, although no such history was obtained in their case. The review of the literature suggested a familial tendency. The case reported in this paper was a first-born child and the mother was later delivered of a second full-term child who presented no abnormalities, either clinically or by roentgenogram. The diagnosis rests on the roentgenographic findings. Routine neonatal films on patients with other congenital defects might reveal a higher incidence of the condition than has previously been suspected. Raap, quoted by the authors, has stated that the stippling disappears by the age of three.—*R. S. Bromer, M.D.*

Valls, José, and Schajowicz, Fritz. Displasia fibrosa de los huesos. (Fibrous dysplasia of the bones.) *Rev. ortop. y traumatol.*, Oct., 1950, *20*, 83–119.

The pathogenesis of monostotic and polyostotic fibrous dysplasia of bone is discussed by the authors. In the series presented, there were 18 monostotic and 8 polyostotic lesions. These cases were studied clinically, roentgenologically and pathologically.

The term monostotic fibrous dysplasia is too broadly used at present inasmuch as there is insufficient evidence to include in this group xanthomatous granuloma, ossifying fibroma and leontiasis ossium. On the other hand, no definite proof exists that they can be considered a dysplasia or osteodystrophy. Further, the histopathological appearance described as characteristic of monostotic fibrous dysplasia can also be observed as the final stage of such lesions as histiocytic granuloma and various inflammatory processes.

In the polyostotic lesions there is clinical and microscopic evidence that they are an embryonal dysplasia, intermediate stages between this and chondrodysplasia having been found. Special histopathological techniques failed to demonstrate nervous tissue, thereby excluding the possibility that the lesions were caused by neurofibromatosis of bone (von Recklinghausen's disease). In the cases which presented genital abnormalities and skin pigmentation the continued use of the term Albright's syndrome is recommended.—*M. M. Friedman, M.D.*

Lebrun, Jacques. La maladie ostéogénique. Sa dégénérescence maligne. (Malignant degeneration in multiple exostoses.) *Acta chir. belg.*, Dec., 1950, *49*, 867–881.

Malignant degeneration occurs in about 5 per cent of cases of congenital multiple exostoses or dyschondroplasia. It is characterized by the slow, localized massive enlargement of one of the exostoses, which accelerates in growth, infiltrates bone and metastasizes after a few years or after the stimulus of incomplete surgery. During the slow period of growth, the roentgenological appearance is that of a cauliflower osteochondroma and the histopathological picture is benign. If the tumor is incompletely removed surgically, recurrence is rapid and histopathologically shows the co-existence of benign chondrofibromyxoma with sarcomatous areas of intense polymorphism. On the other hand, complete surgical removal may be curative.

The author describes one case which exemplifies the malignant change in one exostosis which is part of a generalized dyschondroplasia.—*S. M. Silverstone, M.D.*

Barsky, Arthur Joseph. Congenital anomalies of the hand. *J. Bone & Joint Surg.*, Jan., 1951, *33-A*, 35–64.

This paper is based on a series of 62 cases and includes a survey of the medical literature for the last thirty years. Over one hundred articles were reviewed, as well as the standard works on paleopathology and six Egyptian papyri. The etiology of congenital anomalies of the hand has not been conclusively established, but at the present time the most acceptable theories are those of maldevelopment or of mutations which are subsequently inherited. The author states he has not found a clinical classification of hand anomalies which seems adequate and he does not offer one as he feels it is impossible to do so. Many congenital anomalies of the hand are not simple defects, but are complicated,

combining a number of related or unrelated malformations. In some instances it is difficult to decide even the main category in which certain cases belong.

The various types of deformities are taken up with illustrative clinical photographs and roentgenograms showing the anomalies of the bones, with also discussion and report of the treatment employed in correcting the deformities. The types of syndactylism are described, followed by symphalangism, a fusion of the interphalangeal joints, usually of the middle phalanx with the proximal or distal. The latter occasionally accompanies syndactylism. Polydactylism, brachydactylism, annular grooves and congenital amputations and cleft hand or lobster-claw hand follow. Defects of the forearm and megalodactylism are also included. The final section deals with miscellaneous anomalies which are difficult of classification such as congenital absence of the long extensors of both thumbs and 2 patients with five fingers on each hand, but no thumb, the latter being mother and son.

The paper is complete, likewise the bibliography, and can be strongly recommended as a reference work from the clinical, roentgenographic and therapeutic standpoints.—*R. S. Bromer, M.D.*

WENGER, H. LESLIE. Transversectomy for scoliosis. *J. Bone & Joint Surg.*, Jan., 1951, *33-A*, 253–256.

In 1934, Bisgard was impressed with the almost invariable development of a spinal curvature in patients who had been subjected to a thoracoplasty operation. The author found that the development of scoliosis postoperatively was dependent upon the intactness of the transverse processes and the various ligaments attached to them. Several patients who had thoracoplasty operations in which the transverse processes were left undisturbed, strikingly confirmed this conclusion. In other instances, it was noted that pre-existing scoliosis, with convexity toward one side, was corrected when a thoracoplasty, performed for a lung lesion, was done on the opposite side. On the basis of these observations, a number of patients with primary scoliosis were treated by transversectomies to correct the curvature of the spine. A case is reported to demonstrate the efficacy and the simplicity of the method. The operation consisted of removal of five transverse processes, one at the apex of the thoracic curve, two from above the apex, and two from below the apex. From 2 to 3 inches of articulating rib was also removed to facilitate the removal of the transverse processes.

A correction of from 28 degrees to 16 degrees was obtained within a period of two weeks following operation. It was not found necessary to use a plaster cast or any other corrective apparatus. The correction has persisted to the present time.—*R. S. Bromer, M.D.*

NACHLAS, I. WILLIAM, and BORDEN, JESSE N. The cure of experimental scoliosis by directed growth control. *J. Bone & Joint Surg.*, Jan., 1951, *33-A*, 24–34.

The experimental production of spinal curvatures which are singularly like the human deformity is based by the authors on the recognition of four facts: (1) that vertebral bodies grow in height by the activity of their epiphyseal cartilages, (2) that epiphyseal growth can be retarded by compression, (3) that power of growth persists after the compression is removed, (4) that unequal elongation of the two sides of the spine will result in spinal curvature. They applied these principles by the unilateral clamping of several lumbar vertebrae in growing dogs. The clamp was inserted so that the epiphyses were not injured. The compression force is developed by the normal growth of the spine against the restraint of the clamp. Corrective clamps were applied after the development of the curvature.

On the basis of the production of rotatory lateral curvatures in 23 normal growing dogs by unilateral growth restraint, the development of a similar deformity in 1 animal with thoracic stapling and the correction of the deformed spine under selective growth control in the 6 dogs reported in the paper, the authors conclude that it is obvious that a method is available for the making and straightening of spine deformities. At present, this is limited to puppies only. If, however, the premises on which this experiment was undertaken hold true for other vertebrates, similar results may be expected in other groups. Thus, the human should react in like manner to directed growth control, since his vertebral bodies gain height by epiphyseal structures and since the epiphyses in his extremities show growth retardation under compression. The operation has been performed on 3 children and has proved to be simple and non-shocking and the children have shown remarkably little discomfort or limitation of activity while undergoing this treatment. A report of end results must await more time, broader experience and further study.—*R. S. Bromer, M.D.*

BROCHER, J. E. W. Die Dysplasie des Wirbelbogens. (Dysplasia of the vertebral arch.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Dec., 1950, *73*, 719–726.

Spondylolisthesis is considered to be an abiotrophic disorder, in which the abnormal disposition is present at birth, but not the definitive manifestation. After a varying latent period, in cases with marked penetrance of the pathological gene, the complete picture of the abnormality emerges during the growth period or even in adult life.

Recent studies have shown that the vertebral arch is formed by perichondral ossification, rather than from a bony center. Spondylolisthesis may occur with abnormalities of the articular facets, with elongation and narrowing of the isthmus, or with actual

bony discontinuity in the isthmus, all manifestations of faulty development. No actual spondylolisthesis was demonstrable in a series of 600 fetal and stillborn specimens, but, on the other hand, the age incidence did not increase after the age of ten to twenty years, suggesting that trauma was not a cause.

The condition is not necessarily symptomatic, explaining the fact that the familial occurrence of the condition has been overlooked until recently. Another argument for the hereditary basis is the frequent association of other vertebral and skeletal anomalies.

Against a traumatic origin is the fact that there has been no case on record of a spondylolisthesis developing in an individual who has been found to have an intact isthmus previously.—*J. J. B. Light, M.D.*

Ponseti, Ignacio, and Friedman, Barry. Changes in the scoliotic spine after fusion. *J. Bone & Joint Surg.*, Oct., 1950, *32-A*, 751–766.

The roentgenograms of 117 cases of scoliosis, treated by fusion of the spine, were studied to determine the changes which occur in the vertebral bodies, in the intervertebral spaces, and in the fused and non-fused segments of the spine. In the cases studied, spine-fusion operation was performed for either of two reasons: (1) in young patients, in an attempt to stop the progression of the scoliosis; (2) in patients after maturity of the skeleton, in order to maintain the correction obtained by traction, wedging or turnbuckle casts. The technique of fusion which was usually employed was that of Steindler, which is a combination of the Albee and Hibbs methods. Tibial and iliac grafts were used to reinforce the Hibbs fusion.

Pseudarthrosis was related to the mobility of the fused spinal segment and to the extent of the fusion. It was very common in fusions of the lumbar spine, but infrequent in fusions of the thoracic spine alone. Spontaneous closure of the pseudarthrosis was often observed when the scoliosis became stabilized.

In idiopathic thoracic and thoracolumbar, and paralytic thoracolumbar curve patterns, short fusions of the main curve and one vertebra above and below it gave the most satisfactory results.

Increase of the scoliosis following the spine fusion was seen when the fused area was either too long or too short. In extensive fusions, increased scoliosis was associated with pseudarthrosis, bending of the graft, or with the addition of more vertebrae to the curve. Where fusion did not reach the ends of the curve, increase occurred above or below the segment.—*R. S. Bromer, M.D.*

Bick, Edgar M., and Copel, Joseph W. Longitudinal growth of the human vertebra; a contribution to human osteogeny. *J. Bone & Joint Surg.*, Oct., 1950, *32-A*, 803–814.

The authors depict in this paper the longitudinal growth of the human vertebral body by a series of sagitally cut specimens taken from fresh autopsy material, ranging from one of an 8 cm. fetus to one of a twenty-three year old adult. The sequence of their specimens indicates that, in longitudinal development, the body of the human vertebra grows as does the diaphysis of a long bone, with true proximal and distal epiphyseal plates. Since this is so, the body of the human vertebra is subject to the same deforming factors which influence the growth of the long bones elsewhere in the body. As a corollary, the authors believe it follows that the same diseases, dyscrasias, metabolic or endocrine disturbances, and asymmetrical pressures of posture or contraction which disturb or retard the growing epiphyseal plates of the long bones in other parts of the skeleton, are operable on the bodies of the vertebrae. So apparently are the effects of roentgen therapy.

Although they state their sections were not cut to show best the histology of the roentgenographically prominent structures lying on the cephalic and caudal surfaces of the vertebral body, the authors believe that their sections demonstrate sufficient evidence to confirm Schmorl's views in regard to longitudinal growth of the vertebral body. The so-called "epiphyseal ring" of the vertebra is misnamed and they state the label should be stricken from scientific terminology. The ring is not an epiphysis and takes no active part in the growth of the body. It is primarily a cartilaginous ring, which ossifies separately. Sometimes incomplete in circumference, it lies on the rims of the superior and inferior margins of the vertebral bodies. Schmorl named the structure the Randleiste which can be translated as the "rim molding." Bick and Copel suggest a more easily remembered name, somewhat in keeping with established usage—the vertebral ring. Longitudinal growth of the vertebral body takes place by means of true epiphyseal cartilage plates, as does the longitudinal growth in the metaphyses of long bones. The vertebral ring lies outside the metaphyseal areas and fuses with the body when longitudinal growth is complete, between the seventeenth and twenty-third years. It acts in this way precisely as do apophyses elsewhere in the skeleton. It, too, is a peripheral structure and, except at the rim of the vertebral body, does not lie in the axis of its longitudinal growth. Its function is still open to question, but in several sections studied by the authors, the fibers of the anterior longitudinal ligament inserted into its substance.—*R. S. Bromer, M.D.*

Davis, Joe B., and Blair, Harry C. Spurs of the calcaneus in Strümpell-Marie disease. *J. Bone & Joint Surg.*, Oct., 1950, *32-A*, 838–840.

The authors observed that men between eighteen and thirty years of age, who presented signs and

symptoms of calcaneal periostitis or spurs of the calcaneus, invariably, also had changes of the lumbosacral spine and of the sacroiliac joints characteristic of Strümpell-Marie disease. At the time of their report, they could not give an accurate description of the pathogenesis of the calcaneal changes associated with the disease. However, the course of one patient confirmed their opinion that the acute calcaneal periostitis observed in the acute phase of Strümpell-Marie disease progresses to the mature spur formation seen during the quiescent stage. Furthermore, they feel that the spur formation at the attachment of the plantar fascia to the anterior portion of the tubercle of the calcaneus is the same as the bony proliferation that occurs in other locations in Strümpell-Marie disease.

Roentgen therapy, which is an established treatment for acute Strümpell-Marie disease, relieves the pain of acute calcaneal periostitis and in some cases may prevent spur formation. The dull, chronic pain typical of mature calcaneal spurs is not relieved by roentgen therapy. This pain is caused by impingement of the subserous bursa between the spur and the sole of the foot. To be effective, treatment must include supination of the calcaneous to enlarge the plantar space and thus prevent impingement of the subserous bursa. This treatment is based on the principle that supination of the hind part of the foot is associated with dorsiflexion of the calcaneus, and that pronation of the foot is associated with plantar flexion of the hind part of the foot and its calcaneus. Supination can be accomplished by a simple metal arch support. When relief is not obtained by conservative measures, surgical intervention is necessary to increase the space for the subserous bursa.—*R. S. Bromer, M.D.*

Baker, Lenox D., Coonrad, R. W., Reeves, Robert J., and Hoyt, W. A., Jr. Marie-Strümpell arthritis. *J. Bone & Joint Surg.*, Oct., 1950, *32-A*, 848–855.

The authors conclude from their clinical observations that it appears that roentgen irradiation affects the cellular changes of Marie-Strümpel arthritis, but they have no evidence that it affects the associated ossifying process once it is under way. In a series of 100 patients with the condition, treated by roentgen therapy plus corrective measures, the results, based on relief of pain, range of motion, and roentgenographic changes, indicated that the therapy can be expected to give approximately the same relief from pain during any stage of the disease. Increase in range of motion can be expected in a fair percentage of the mild and moderately advanced cases. Although there is relief from pain, a decrease in range of motion and further ossification may occur. In the mild or moderately advanced cases, the process can be arrested and in some instances cleared by roentgen therapy. Of the 47 patients in the mild or moderately advanced groups, 15 showed roentgenographic clearing of the bone changes; 24 showed no change or advance in the disease; only 7 showed advance with additional ossification. Comparison with the advanced group of 32 patients showed that roentgenographic improvement can be expected in the earlier cases more frequently than in the advanced cases, where the changes are no longer reversible. Roentgen therapy in most instances consisted of 150 roentgens (200 kv.), given over areas measuring 5 by 15 cm. until the entire spine or the area to be treated had been covered. In the group, classified as having moderately advanced changes, 4 showed evidence of further ossification; 2 had only one series of therapy consisting of a total of 450 r; 1 had a total of 1,350 r. Of the 11 patients whose process showed clearing by roentgenograms, 2 had only one series of 450 r, 2 had three series totaling 900 r, and 1 had a total of 1,350 r.—*R. S. Bromer, M.D.*

Gulledge, William H., and Brav, Ernest A. Non-tuberculous thoracic kyphosis with paraplegia; case report. *J. Bone & Joint Surg.*, Oct., 1950, *32-A*, 900–903.

The infrequency of case reports of scoliosis and kyphosis with paraplegia, excluding spinal deformities due to tuberculosis, indicates the rarity of the condition. The authors found only 41 cases in the literature. The remarkable features of their case was the presence of severe thoracic kyphosis rather than scoliosis which is reported in most patients, and the late development of progressive neurological changes after a long period of years without the occurrence of either superimposed trauma or any obvious exaggeration of the bone deformity. Operation gave encouraging results and the prognosis for resumption of ordinary civilian activity appears to be favorable.—*R. S. Bromer, M.D.*

Kersley, G. D., Mandel, L., and Jeffrey, M. R. Gout; an unusual case with softening and subluxation of the first cervical vertebra and splenomegaly; result of ACTH administration and eventual post-mortem findings. *Ann. Rheumat. Dis.*, Dec., 1950, *9*, 282–304.

This is a detailed case report of gout in a young white male. The most unusual feature was sudden subluxation of the first cervical vertebra due to tophaceous softening, a condition not previously reported. There was rapid progression of the disease and fatal termination at the age of twenty-four.

First symptoms were at age of eighteen, and from nineteen on he was almost continuously suffering attacks of pain and swelling in many joints. When first seen by the authors at the age of twenty-one he was wasted, anemic, debilitated, with evidence of involvement of almost all joints. Tophi were present in the ears; the spleen was palpable; plasma uric acid was 16 mg., and later 17.3 mg. per 100 ml.

Roentgen therapy was administered to one foot, 150 r being given at each of four exposures. There was acute exacerbation, followed by sufficient improvement that the patient requested similar treatment for the other foot.

There is discussion of colchicine and ACTH therapy, splenectomy, and autopsy findings.—*A. A. Brewer, M.D.*

Forestier, J., and Rotes-Querol, J. Senile ankylosing hyperostosis of the spine. *Ann. Rheumat. Dis.*, Dec., 1950, *9*, 321–330.

The authors describe a condition they term senile ankylosing hyperostosis of the spine; they differentiate this from ankylosing spondylitis and spinal osteoarthritis (hypertrophic spurring and lipping).

Roentgenological features: Bony outgrowths arise from the anterior aspects of vertebral bodies, but not from the lateral aspects. There results in the dorsal spine a continuous but irregular outgrowth alongside the anterior aspect. In the cervical and lumbar regions the outgrowths are usually broken and they project upward from the superior aspects, but not downward. The outgrowth is thickest at the disc levels. In the anteroposterior views the bodies may appear fuzzy and striated due to the overlying bony process. The sacroiliac joints are not involved.

Clinical features: The condition has been seen only in men, at an average age of sixty-five. There is spinal stiffness but no spinal pain, peripheral joint involvement, or invalidism, and the sedimentation rate is normal. Severe trauma may have been the precipitating cause in 3 cases. Ossification appears to arise in the continuous perivertebral fibrous sheath, rather than the anterior vertebral common ligament.—*A. A. Brewer, M.D.*

Lucchesi, Marcello, and Lucchesi, Oswaldo. Rheumatoid spondylitis; a paediatric problem. *Ann. Rheumat. Dis.*, Dec., 1950, *9*, 372–376.

These Brazilian authors have encountered rheumatoid spondylitis in 17 children below the age of ten years. They point out that the symptoms are different from those of acute rheumatic fever and may consist of little more than fixation of the neck. Pain is the most consistent symptom and it may be of short duration, fleeting or intermittent for months. There was no fever, weight loss or cardiac involvement. General health remains good in spite of the pain which is located in the spinal column either in the cervical or lumbar areas. The authors' cases showed alterations in the blood count, but these were explained on the basis of parasitism.

In advanced cases the roentgen changes are those of spondylitis with fusion of joints and calcification of ligaments, but in many cases, especially early, the roentgen findings are nil. No cases are presented in detail in this paper.

The authors emphasize the fact that since such rheumatic involvement occurs in young individuals, the disease is of pediatric significance.—*C. L. Hinkel, M.D.*

Friedenberg, Z. B. Osteitis pubis with involvement of the hip joint. *J. Bone & Joint Surg.*, Oct., 1950, *32-A*, 924–927.

Osteitis pubis is generally considered an affection limited to the pubis and the ischium, developing as a complication of suprapubic prostatectomy. In the case reported in this paper, osteitis pubis developed after a prostatectomy and subsequently the process involved the hip joint with gradual destruction of the joint. The author found only one other such report. An eight month interval elapsed between the suprapubic prostatectomy and the development of hip pain, during which his original complaints referable to the anterior pelvic region completely disappeared. The course of the disease, both clinically and roentgenographically, resembled a low grade osteomyelitis. *Pseudomonas* was cultured from the urine on numerous occasions over a period of more than eighteen months and the same organism was cultured from the hip joint.

Friedenberg suggests that our concept of the disease as a localized, self-limited process confined to the anterior pelvic girdle should be altered. It is possible that less dramatic changes in the hip joint, occurring long after the initial period of the disease, are being overlooked.—*R. S. Bromer, M.D.*

Spota, B. B., and Bardeci, C. A. Espondilitis tífica con compresión medular dorsal; presentación de enferma. (Typhoid spondylitis with compression of the spinal cord; presentation of a case.) *Prensa méd. argent.*, Dec. 15, 1950, *37*, 3035–3039.

Twenty years after typhoid infection, the patient, a forty-four year old woman, was hospitalized for intense pain in the left shoulder and arm. The roentgenograms revealed extensive osteoporosis of the posterior arch of the first dorsal vertebra. Less osteoporotic change was present in the vertebral body, and there was no involvement of the discs. In the course of hospitalization, complete paraplegia developed with sensory disturbances of the foot and leg. Typhoid reaction was positive. Following antityphoid vaccine and streptomycin therapy, rapid improvement could be demonstrated roentgenographically and, after four months, the patient was able to move the paraplegic limbs and to walk again. Some sensory disturbances remained.

The unusual clinical feature of this case is the late appearance of neurologic symptoms indicating total paraplegia and complete subarachnoid blockage, apparently due to pressure from extradural typhoid abscess. Roentgenologically the presence of osteoporosis is also unusual since generally hyperostosis

and osteosclerosis are considered typical for chronic typhoid involvement of the vertebral column.—*E. A. Schmidt, M.D.*

SOHOLT, STANLEY T. Tuberculosis of the sacroiliac joint; review of seventy-five cases. *J. Bone & Joint Surg.*, Jan., 1951, *33-A* 119–130.

The author states that separate consideration of the sacroiliac joint is particularly indicated in any study of bone and joint tuberculosis because of the unique anatomy and function of the joint, and because the diagnosis is frequently so delayed that definitive treatment is instituted late in the course of the disease. In the review of his cases he found that the disease occurred in young adults, usually between the ages of twenty and forty years. It was commonly associated with tuberculosis in other parts of the body. Pain was the initial symptom. Abscess formation occurred frequently, usually followed by formation of a draining sinus. The usual roentgenographic appearance late in the disease was bony ankylosis. The mortality was higher when there was a draining sinus and the data suggest, but do not prove, that operative fusion of the involved sacroiliac joint is of value in hastening the desired end result.—*R. S. Bromer, M.D.*

SHIPP, FRANK L., and HAGGART, G. EDMUND. Further experience in the management of osteitis condensans ilii. *J. Bone & Joint Surg.*, Oct., 1950, *32-A*, 841–847.

The term osteitis condensans ilii is used to describe a disturbance of the normal architecture of the ilium, alongside the sacroiliac joint. Roentgenograms show increased condensation in the auricular portion of the ilium, in the absence of any corresponding change in the sacroiliac joint or in the contiguous sacrum. The authors recommend the flat sacral projection for roentgen examination of the sacroiliac articulations. The condition is found in the female where the sacrum tends to lie in a more horizontal plane than in the male. The auricular portion of the ilium is most commonly involved. This auricular portion lies behind the anterior margin of the joint, so that condensation therein may give a false impression of involvement of the sacrum or even of the sacroiliac joint. In the authors' series of cases there was usually no sharp definition between normal and abnormal bone. In roentgenograms, roughening and apparent widening of the joint itself can be seen early in Marie-Strümpell arthritis, a differential point in making the diagnosis of osteitis condensans ilii.

From the authors' observations they think that the alteration in the normal bony architecture of the ilium alongside the sacroiliac joint occurs as the result of mechanical strain affecting an amphiarthrodial joint. A careful differential diagnosis must be made between osteitis condensans ilii and Marie-Strümpell arthritis. Contrary to their own original impressions, sacroiliac tests are seldom positive in osteitis condensans ilii, while the blood sedimentation rate is usually within normal limits. In contrast to the experience of earlier workers, the authors believe they have demonstrated roentgenographically that this process is reversible. Of 100 patients reviewed, 8 showed no response to treatment and 23 were somewhat improved; in 67 patients conservative treatment afforded either complete relief of symptoms or marked amelioration of their complaints. Surgical intervention was necessary in only 2 instances.—*R. S. Bromer, M.D.*

DEL DUCA, VINCENT, DAVIS, E. VERNON, and BARROWAY, JAMES N. Congenital absence of the sacrum and coccyx; report of two cases. *J. Bone & Joint Surg.*, Jan., 1951, *33-A*, 248–253.

In this paper, 2 cases of congenital absence of the sacrum and coccyx, known also as sacrococcygeal agenesis, are reported. In the first case the condition was unrecognized until the child was four years of age. Roentgen examination during the postpartum period revealed the anomaly in the second child.

The condition may be recognizable without roentgen examination by the absence of the spinal column below the lumbar region which results in obvious narrowing of the pelvis and shortening of the intergluteal fold. Atrophy and dimpling of the buttocks are prominent manifestations, probably due to fibrous tissue contraction. The muscles of the lower extremities show atrophy which becomes increasingly prominent as skeletal growth progresses. Clubfoot is a frequent accompaniment.

The authors mention some of the theories of the etiology of the condition. The anomaly must develop during the early days of fetal life. Heredity may exert an influence as appendicular skeletal anomalies are inherited to a marked degree and some axial skeletal defects have also been known to have a hereditary basis. A more remote possibility is that of conjoined twins with dorsal union in the sacral area. One twin may have died in early pregnancy due to poor nutrition and the other proceeded to term with the persisting defect in the sacral portion of the spinal column.—*R. S. Bromer, M.D.*

MAKIN, MYER. Osteochondral fracture of the lateral femoral condyle. *J. Bone & Joint Surg.*, Jan., 1951, *33-A*, 262–264.

A tangential osteochondral fracture of the patella is an infrequently reported condition. It is generally agreed that the mechanism of the injury is due to a lateral dislocation of the patella which hooks itself over the lateral femoral condyle. Upon contraction of the quadriceps, the patella is pulled back into place; if the patella does not clear the projecting femoral condyle, a portion of its articular surface is

sheared off, producing the typical osteochondral patellar fracture.

In all cases previously reported where the forces involved have been indirect and purely muscular, the patella has borne the brunt of the injury. The trauma to the lateral femoral condyle has been slight and incidental. In the case presented by the author in this report, it was clear that the inferolateral border of the lateral femoral condyle was knocked out by the spontaneous reduction of the dislocated patella, and an osteochondral fracture of the femoral condyle was produced. The pathological report confirmed the fact that the loose body was traumatic in origin and was not to be confused with a loose body resulting from osteochondritis dissecans.

The roentgenograms of the patient showed a crescent-shaped bone fragment loose in the joint in the medial parapatellar region of the joint. A bony defect in the inferior aspect of the lateral femoral condyle was caused by the shearing off of the fragment.—*R. S. Bromer, M.D.*

Yu, Horace I. Tuberculosis of the hip; follow-up study of fifty-eight cases with special reference to fusion in young children. *J. Bone & Joint Surg.*, Jan., 1951, *33-A*, 131–143.

The author concludes from his study of 58 cases of tuberculosis of the hip that there is added proof that early fusion in young children is amply justified. Conservative measures aimed at building up the general health and causing the subsiding of acute symptoms, during the initial period of three to six months, are necessary for a smooth postoperative course. In view of the present-day antibiotic therapy, even this short period of conservative treatment may be safely curtailed in some cases. In this way the long recumbency in some forms of immobilization, and the distressing deformities, which usually follow long years of destruction from lack of internal fixation, may be avoided. Two cases of spontaneous fusion, which are reported in this paper, had probably been transformed from an originally tuberculous infection to that of a predominantly pyogenic infection through long years of secondary invasion and repeated surgical drainages.

In the author's series, the average time for roentgenographic evidence of fusion to appear after arthrodesis in a hip was fifteen months in children and twelve months in adults. He considers that real anatomical fusion with transarticular trabeculae may take an additional one or more years. It seems to him advisable that no secondary fusion operations be undertaken before the fifteenth month in children or before the twelfth month in adults; that the average immobilization period be from twelve to eighteen months in children and ten to twelve months in adults; and that the time for beginning ambulation be sooner than six months following arthrodesis in any case.—*R. S. Bromer, M.D.*

Anderson, Martin E., and Bickel, William H. Shelf operation for congenital subluxation and dislocation of the hip. *J. Bone & Joint Surg.*, Jan., 1951, *33-A*, 87–102.

The authors in their summary state that although the exact cause of congenital dysplasia of the hip is unknown, genetic and biomechanical factors are probably important in producing the malformation, which may be hereditary and frequently involves both hips in varying degrees. The determination of the CE angle of Wiberg is helpful in classifying the various degrees of subluxation of the hips as revealed by the roentgenogram. Wiberg reported in 1939 a simple objective method for measurement of slight changes in the development of the roof of the acetabulum and its relationship to the position of the head of the femur. The CE angle is measured by drawing a line from the center of the head of the femur to the lateral edge of the roof of the acetabulum. The angle which this line forms with a vertical line through the center of the head of the femur is the CE angle. The vertical line is drawn perpendicular to a horizontal line across the pelvis, through the centers of the primary acetabula. The center of the head of the femur is the center of the arc described by the curvature of the head of the femur. This procedure is simplified by using a transparent circular protractor, on the face of which are drawn several concentric circles. The center of the head of the femur is the center of that circle which best encloses the head. The CE angle is read in either plus or minus degrees. When the head of the femur is not adequately covered by the roof of the acetabulum, the CE angle will be low or minus. The angle becomes less when the size of the acetabular roof decreases and when the head of the femur is displaced laterally. The authors divided their cases into four groups according to these measurements, namely, normal hips; dysplasia or deformity of the femoral head, neck or acetabulum but no subluxation; subluxation or displacement of the head upward and laterally with a break in Shenton's line; dislocation with the head of the femur articulating with a secondary acetabulum separate from the primary acetabulum or with no secondary acetabulum present.

The shelf operation consists in construction of an adequate bone ledge or shelf on the side wall of the ilium over the head of the femur, after the femur has been displaced downward by traction. The purpose of the operation is to increase the weight-bearing surface of the malformed acetabulum and thus to afford stability for the subluxated or dislocated femoral head.

In a series of 80 operations for congenital subluxation or dislocation of one or both hips, 58 were successful in producing partial or entire relief of limp, pain and hip fatigue, while a good range of motion was retained in the hip operated upon. Twenty-two of the operations were unsuccessful, in that the pa-

tients' symptoms were unimproved. Poor results were attributed to construction of shelves which were inaccurately placed, were too small or were absorbed. Arthritic symptoms persisted or developed after operation in a few instances.—*R. S. Bromer, M.D.*

MINDELL, EUGENE R., and SHERMAN, MARY S. Late results in Legg-Perthes disease. *J. Bone & Joint Surg.*, Jan., 1951, *33-A*, 1–23.

Ever since Legg-Perthes disease was recognized as a distinct entity, its treatment has been the center of considerable controversy. The study presented in this paper was undertaken in an attempt to evaluate treatment in terms of end-results. Included in the study were only those cases in which the diagnosis was unquestioned; the type of treatment known and the clinical and roentgenographic findings were available after the disease was over. Seventy-two patients with seventy-eight involved hips met these requirements.

In the paper, the type of therapy is classified as ambulatory or non-ambulatory. In some cases both types were used. However, during the prolonged period of active breakdown and replacement of the necrotic head of the femur, one method always predominated. For purposes of analysis, the results were strictly classified as satisfactory, fair, or poor, even though the differences in many cases were not great.

The authors believe that the prognosis in a case of Legg-Perthes disease can in a general way be estimated early in its course. Young patients have been shown to have a higher incidence of satisfactory results. Evidence of severe femoral neck disturbance with damage to the epiphyseal plate is followed by a poor result with deformity. Often only a portion of the epiphyseal cartilage is damaged and the result is asymmetrical growth disturbance and retardation, which may not become evident for some time.

The authors conclude that, in the natural course of the disease, there is a wide variation in the severity of the process. Marked changes in the femoral neck and lateral expansion or central depression of the femoral head indicate a bad prognosis. Premature symmetrical or asymmetrical growth arrest of the capital femoral epiphyseal cartilage plate may occur and contribute to the deformity. In the presence of gross changes in the roentgenograms, there may be a few or no symptoms in early life. However, as the patient becomes older, progressive disability does occur. Therefore, patients should be treated and treated early. Inasmuch as there seems to be no significant difference in the results obtained by ambulatory or non-ambulatory treatment, non-weight-bearing on crutches is sufficient in a cooperative patient with unilateral involvement.—*R. S. Bromer, M.D.*

MOSSBERGER, JOSEPH I. Infantile cortical hyperostosis; report of a case with observations at autopsy. *Am. J. Dis. Child.*, Oct., 1950, *80*, 610–620.

A case of infantile cortical hyperostosis is reported with lesions observed at necropsy which included "cortical" thickening of various bones, generalized lymphadenopathy, and incidentally perhaps, acute focal enteritis. In the paper, the gross and microscopic appearances of the left humerus are described in detail. The bone disorder showed most of the morphologic features of excessive embryonal osteogenesis.

Mossberger regards the possibility of a relationship between the ileitis and generalized lymphoid hyperplasia and skeletal disease as quite conjectural. In regard to the sudden death of the infant, there was not enough involvement of the lungs to presuppose pulmonogenic hypoxemia as the death-dealing process. The enteritis could not account for the fatality. The histopathologic aspects of the lymph nodes and Peyer's patches suggested typhoid. Acceleration of the osteogenesis was confined only to the periosteal elements. As a result, the length of the long bones was not increased. Comparison with normal bones of the same age suggested that epiphyseal function may have been decelerated, with resulting shorter bones than normal. Possibly excessive vitamin A, speculatively admissible as a factor in the case, upset the metabolic balances enough to retard linear growth and to accelerate periosteal activity. Pain in the arms and sleeplessness could have been due to stretching and irritation of sensory end organs in the periosteum. Lymphoid hyperplasia and lymphocytosis may have been compensatory for decreased hemopoiesis in the bone marrow and anemia.

The case, the author states, is baffling and the cause of the patient's death remains unknown. He thinks if the bone lesion of the infant is the result of excessive osteogenesis due to a disturbed metabolic process, initiated by some stimulus of an infectious nature, then its clinical course can be understood. Elimination or neutralization of the causative agent brings about osteoclasis and reversion to normal osteogenetic balance.—*R. S. Bromer, M.D.*

LARSEN, LOREN J., SCHOTTSTAEDT, EDWIN R., and BOST, FREDERIC C. Multiple congenital dislocations associated with characteristic facial abnormality. *J. Pediat.*, Oct., 1950, *37*, 574–581.

The authors report a series of 6 cases of children with multiple congenital dislocations associated with characteristic facial changes. The most obvious deformity was anterior dislocations of the tibias on the distal ends of the femurs. Also there were antenatal dislocations of the hips, bilateral equinovarus or equinovalgus deformities of the feet and bilateral dislocation of the elbows. All 6 cases had unusual hands with long cylindrical-shaped fingers and short metacarpals. The thumbs were spatulate.

The facies were very striking. The eyes were widespaced, the forehead prominent, and the nasal bridge depressed, producing a flattening of the face. Mental and bone development were normal. Photographs of the children are shown to illustrate the facies and films reproduced to show the dislocations.—*R. M. Harvey, M.D.*

Caffey, John, and Williams, John L. Familial fibrous swelling of the jaws. *Radiology*, Jan., 1951, *56*, 1–14.

Familial painless enlargement of the jaws was first recorded by Jones in 1933. In 1947, Miller published 2 similar cases. In this paper 5 cases are reported, 2 children and their mother from one family and a child and his father from another family.

This disease is characterized by bilateral painless enlargement of either or both upper and lower jaws. The process is not apparent at birth but usually is first noted at the age of two or three. The roentgen findings consist of extensive multilocular cyst-like areas with expansion of the bone and distortion of the erupted and unerupted teeth. The coronoid process may also be involved. No other skeletal abnormalities could be detected in these 5 cases, and clinical examination of all 5 patients showed no evidence of other disease or abnormality except for submaxillary lymphadenopathy. This occurred in all children except the 1 case reported by Jones. Multiple biopsy specimens were obtained from the jaws of 1 of these children. Microscopic examination showed excessive amounts of fibrous tissue with whorls and bands and containing giant cells. No cysts, cartilage or osteoid tissue could be found in the fibrous mass.

It is of interest to note that at about the age of ten the external appearances of the patients begin to improve. This decrease in swelling occurs rapidly during puberty and very little prominence of the jaws is noted in the adult.

Fibrous dysplasia, fibrous osteoma, osteofibroma, ossifying fibroma and multiple dentigerous cysts must be considered in differential diagnosis but the familial nature of this disease, its early onset, involvement of either or both the upper and lower jaw plus its self limited course should help make the correct diagnosis.—*C. A. Stevenson, M.D.*

Pedersen, Herbert E., and Key, J. Albert. Pathology of calcareous tendinitis and subdeltoid bursitis. *Arch. Surg.*, Jan., 1951, *62*, 50–63.

This is a discussion of the gross and microscopic appearance of the lesions found in the rotator cuff of the shoulder in the condition commonly termed subdeltoid bursitis with calcification. The material consists of observations at the time of operation, and the gross and microscopic study of material removed in 55 patients.

At operation, in most instances, the bursa contained only a small amount of thin, clear synovial fluid and the floor was smooth except for the area in which the calcium deposit or deposits were located. When this was large and the symptoms were acute, it was usual to find a furuncle-like protrusion in the floor of the bursa, sometimes associated with fibrinous adhesions to the inflamed surface of the swelling. The focus involved the substance of the supraspinatus tendon and projected slightly above the surrounding surface. In the acute cases, when the focus was incised it was found to contain a thick, white, cream-like fluid, which in some instances spurted into the air when the incision was made. In other instances, the site of the focus was indicated by a slight rounded prominence in the floor of the bursa, but there was no evidence of acute inflammation at the site, nor was there any discoloration in the tendon. In such instances it was found that the incision in the tendon exposed a focus deep in its substance which was relatively flat and usually contained dry, chalk-like material. When the calcium was removed from the focus in the tendon, a cavity with ragged, necrotic, poorly defined walls was encountered. These walls were dry and appeared to be avaxcular. In many instances, when additional longitudinal incisions were made into the tendon on either side of the main calcium deposit other foci, varying in size from lower limit of visibility to some 1 cm. or more in diameter were encountered. These foci were not visible on the roentgenogram, nor was there any indication of their presence on examination of the surface of the tendon.

Histopathologically, the earliest signs of degeneration appeared to be in the tendon consisting of hyalinization and softening, with loss of its fibrous character and usually a loss of its ability to stain deeply with eosin so that the area appeared pale pink, and contained relatively few connective tissue cells. The large cyst-like cavities in the tendon which enclosed the white calcium-containing fluid were believed to be the result of progressive degeneration of the tendon. That calcium was present in this material has been proved by chemical analysis, which demonstrated calcium phosphates and carbonates in about the same proportion as that in which they occur in bone. The reaction of the surrounding tissues to the calcium-containing focus of tendon debris varied from one of complete absence to various stages of inflammation and repair.

The findings described substantiate and broaden those previously reported. There will undoubtedly continue to be much debate on the exact cause of the underlying degeneration of the tendon.—*E. A. Addington, M.D.*

O'Neal, Lawrence W., and Ackerman, Lauren V. Cartilaginous tumors of ribs and sternum. *J. Thoracic Surg.*, Jan., 1951, *21*, 70–108.

The authors reviewed 75 cases of cartilaginous tumors of the bony chest wall and report 11 cases with

a pathologic diagnosis of chondrosarcoma. Cartilaginous tumors are the most common type of primary tumor of the ribs and sternum. Cartilaginous tumors of ribs and sternum are either actually malignant or potentially malignant to a high degree. Sixty of the 85 cases included in this study were diagnosed as malignant. Undoubtedly many of the remaining 25 cases are malignant. Primary malignant tumors of rib and sternum constitute approximately 10 per cent of all primary malignant bone tumors.

The preoperative differentiation between malignant and benign cartilaginous tumors cannot be made with certainty.

The results of treatment in the past has been poor, partly because of failure to appreciate the nature of these tumors. Adequate radical resection of chondrosarcomas arising in rib and sternum entails removal of a long segment of bone of origin, its periosteum, adjacent muscle, underlying pleura, and adjacent bony structure.—*T. C. Stansbury, Jr., M.D.*

GIANTURCO, C. Radiological aspects of primary bone tumors. *Selected Papers Carle Hosp. Clin. & Carle Found.*, Jan. 1, 1951, *4*, 11–17.

The classification used by the author is that of Geshickter and Copeland, namely (1) tumors related to osteogenesis which are in turn subdivided into tumors related to development of cartilage and those related to other elements, and (2) tumors not related to osteogenesis. A general discussion of the common bone tumors is given and a schematic drawing is included illustrating the sites of their origin in relation to various parts of the bone. Twelve film reproductions of typical bone tumors are also included.

This paper gives a concise and well demonstrated review of the Geshickter-Copeland classification.—*C. N. Borman, M.D.*

ROBINSON, MARSH. Polyostotic fibrous dysplasia of bone. *J. Am. Dent. A.*, Jan., 1951, *42*, 47–57.

After a brief review of the history, pathology, etiology, and usual findings in polyostotic fibrous dysplasia of bone, the author points out that many cases have involvement of the facial bones and mandible.

He presents 2 cases with photographs of the patients, dental films, and photomicrographs of the pathological sections. Both patients had pigmentation, bone lesions, and hyperthyroidism. Case 1 also had precocious puberty, but Case 2 had a normal menstrual history.

Intraoral films on both patients showed an irregular loss of the cancellous structure of the bone with the mandibles having a ground glass appearance. The biopsy material exhibited fibrous dysplasia of bone. Skeletal survey revealed multiple bone involvement. In Case 1, the diagnosis was made in the dental department—the patient having had a previous diagnosis of achondroplastic dwarf. In Case 2, the diagnosis was suspected by the referring physician and the dental department was requested to secure a biopsy to confirm it, since a diagnosis of Paget's disease of bone was made elsewhere.

The author stresses the value of taking biopsy material from the jaws when they are involved because the average patient is far more willing to have study material removed from the jaws than from other bones. The dental surgeon's familiarity with such a procedure makes it relatively simple for all concerned. He also stresses the advantages in definition and detail of full mouth intraoral films over the usual roentgenograms of the mandible and states that dental films should supplement the usual skeletal survey.

Many diseases must be considered in the differential diagnosis but none shows the combined clinical, roentgenographic, and pathologic findings of polyostotic fibrous dysplasia. The diagnosis depends on an awareness of the condition and on the cooperation of the physician and dental surgeon in patients who have involvement of the jaws.—*W. H. Smith, M.D.*

DOCKERTY, MALCOLM B., GHORMLEY, RALPH K., and JACKSON, ALFRED E. Osteoid osteoma; a clinicopathologic study of 20 cases. *Ann. Surg.*, Jan., 1951, *133*, 77–89.

The authors point out that since 1935 when Jaffe described "osteoid osteoma" as a distinct entity, some 36 groups of investigators have reported single cases or series of cases with the current total of cases reported approaching 150.

Osteoid osteoma is a definite entity as affirmed by the many case reports, the highlights of which the authors tabulate. In the present series, all lesions were evaluated and correlated as to the clinical, roentgenologic, and pathologic findings. Thirteen of the 20 patients were from ten to twenty years old. There were 16 males and 4 females. The femur was involved in 8 cases, the tibia in 7, the ulna accounted for 2 lesions while the humerus, vertebra and scapula were each the seat of osteoid osteoma in one instance. Pain was a constant symptom and was present in all cases. Eleven patients had local swelling over the involved part and 4 mentioned redness and local heat. A palpable mass was noted in 12 patients but not always in the same who had localized tenderness.

The roentgen findings were as follows: In the early stage, sometimes no abnormalities were seen although typical clinical symptoms were present (5 patients, 25 per cent of the series). Later, however, all the affected bones showed evidence of periosteal proliferation. In these later roentgenograms, in 19 of 20 cases, typical radiolucent zones measuring from 3 mm. to 2 cm. were observed. In 5 patients these zones contained irregular foci of calcification. In the 1 case in which the transverse process of a vertebra was involved, the entire bony structure had

been destroyed and there was no surrounding bony sclerosis. In the other 19 cases relatively extensive osteosclerosis was noted around the radiolucent nidus. The degree and extent of the sclerosis had no apparent fixed relation to the age of the lesion as measured in terms of clinical symptoms and signs. Calcification within the central nidus similarly was seen during the early and late stages of the disease.

The authors discuss the differential diagnosis and treatment as well as the etiology of osteoid osteoma. They state that the true etiology remains obscure. Review of the cases previously reported as solitary cortical abscesses reveals that from the standpoint of history, clinical findings, and roentgenograms, these cases could not be distinguished from the present cases of osteoid osteoma. This brought up the following questions: Are osteoid osteomas and solitary cortical abscesses two phases of an essentially similar process? Are they variants of a single process or two different lesions with similar clinical and roentgenographic features? In 1 case included in the present series (Case 18) there was what was considered a true neoplastic change. In another case with typical clinical and roentgen findings but not operated, follow-up roentgenograms showed that the lesion finally disappeared.

The authors conclude that the above-mentioned observations have led them to believe that the lesion may at times develop one type of pathologic picture and at other times a different picture. Four tables and twelve figures accompany the article.—*W. H. Smith, M.D.*

Wigh, Russell, and Thompson, Harvey J., Jr. Cortical fissuring in osteomyelitis complicating sickle-cell anemia. *Radiology*, Oct., 1950, *55*, 553–556.

A fourteen year old colored boy who had been under observation four years because of typical sickle-cell anemia became acutely ill with a fever of 105° F. He developed sore muscles and joints and after five weeks an abscess developed on his right tibia from which *B. paratyphosus B* was cultured.

Roentgenographically the source was shown to be an osteomyelitis of the tibia. Osteomyelitis was demonstrated in most of the extremities. The usual destructive feature predominated but periostitis was present in several regions. The disease was diaphyseal rather than metaphyseal in position.

A distinctive feature was the presence of linear intracortical fissuring paralleling the shaft which was clearly defined as lying between cortex and endosteal limits. These fissures are described in detail.

The patient received both aureomycin and streptomycin over a period of twenty-four days. Healing of the intracortical lesions paralleled that of the intramedullary lesions in time sequence. Sequestration and involucrum formation did not occur.—*E. E. Seedorf, M.D.*

Lüdeke, H. Über das gehäufte Vorkommen parostaler Knochenneubildungen bei Querschnittsgelähmten. (The frequent occurrence of parosteal new bone formation in paraplegics.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Oct., 1950, *73*, 564–574.

The similarity between Stieda's "accompanying shadows" and the lesions occurring in paraplegics is noted. The heterotopic ossification has no intimate connection with the periosteum or joint capsule. On section the material is composed of coarse and fine fibrous lamellar bone. The involvement in paraplegics is more extensive than in the traumatized, non-paralyzed individuals, but the distribution of the ectopic bone about the knee joint is the same, namely on the ventromedial aspect of the inner femoral condyle.

The etiology of these conditions is unknown. The Pellegrini-Stieda lesion is probably a post-traumatic ossification in connective tissue but whether it represents a metaplasia of young mesenchyme to osseous tissue or whether the bone is derived from periosteum is not clear. It is felt that in paraplegics a neurotrophic disturbance alone cannot explain the changes. Repeated, minimal and unrecognized traumas in an insensitive joint undoubtedly play a major role. The factors in the pathogenesis of the new bone are tissue laceration, hemorrhage, poor absorption of the blood and most likely metaplasia from existing muscular and connective tissue.—*Joseph Zausner, M.D.*

Fraser, Charles G., Monroe, Stanley E., and O'Hare, James E. Coccidioidomycosis and tuberculosis in the same bones; case report. *Ann. Surg.*, Jan., 1951, *133*, 116–122.

The authors present a case study of a patient in whom tuberculosis and disseminated coccidioidomycosis occurred in the same bones. The etiology, pathology, and symptomatology, as well as the diagnosis are summarized.

The patient described has lived with the disseminated coccidioidomycosis for over one year now although it is reported in the literature that 95 per cent of the cases of deaths from dissemination of this disease occur within 210 days. The authors feel that the successful use of streptomycin healed the tuberculosis, transforming the condition into pure coccidioidal infection. The patient is steadily improving and his prognosis is considered good.—*Moris Horwitz, M.D.*

Bosworth, David M. Tuberculosis of bones and joints. *Bull. New York Acad. Med.*, Jan., 1951, *27*, 42–60.

This paper represents a summation of the author's philosophy with regard to bone and joint tubercu-

losis. In it, he briefly reviews the etiology, diagnosis and prognosis of the disease. Under etiology, he points out the fallacy of the belief that heredity and race may influence the progress of the disease. Under diagnosis, he discounts the time-honored clinical signs of swelling, effusion, spasm, atrophy, deformity, etc., as being related to "late" lesions, and he points out that even skin tests and sedimentation rates must be given up as criteria of presence or absence of disease. From a roentgen viewpoint, in order to ascertain the presence of an early lesion: "soft tissue changes . . . represented by general swelling, erasure of normal soft tissue markings or unusual enlargement of certain muscle sheaths or fascial planes" must be watched for and reported. Bone changes evident roentgenographically as atrophy, destruction, lysis of cartilage, etc., are later manifestations.

The author correlates the clinicopathologic changes of inflammation, disease extension, endarteritis, abscess bulk, deformity and pathological fracture. The last topic is well expressed in a paragraph in which he makes a plea that fracture or other bone destruction resulting from a tuberculous process be looked upon as a pathologic fracture.

Under the heading of "Factors of Failure" he discusses ineffectual surgery. He feels that bone grafting should be ample in amount and extent. He points out that frequently a pseudo-arthrosis may be present but not detectable by routine films and suggests superimposition of films taken in right and left lateral bending positions.

Also under failures, he mentions bony pockets and sequestra. These may at times be demonstrated by laminagraphy.—*I. R. Berger, M.D.*

McCRORIE, W. D. C. Fractures of the femoral neck following pelvic irradiation; review of ten cases. *Brit. J. Radiol.*, Oct., 1950, *23*, 587–592.

Fracture of the femoral neck may infrequently follow intensive pelvic irradiation, as for carcinoma of the ovary or cervix uteri. The reported incidence is about 1 or 2 per cent. In a series of 10 cases it was noted that the pain sometimes preceded the fracture which was demonstrable by roentgen rays only later. Sometimes the pain developed very suddenly with the fracture although there was no history of injury. The interval between the completion of the radiation treatment and the actual fracture may be considerable. No satisfactory explanation of the occurrence has been given. It is reasonable to expect aseptic necrosis if it were merely the result of vascular damage, but this is not seen. The significant finding microscopically is osteoporosis. Enlargement of the blood vessels as a reaction or response to the irradiation may play a part in the development of this osteoporosis. A second possibility is the differential effect of irradiation on osteoblasts and osteoclasts. The former are more radiosensitive, and a dose large enough to affect the more resistant osteoclasts would result in osteoporosis. Mild or unnoticed trauma might fracture such a bone.

These fractures usually heal fairly rapidly and with solid bony union.—*E. F. Lang, M.D.*

MONTGOMERY, CHARLES F. One hundred consecutive trochanteric fractures of the hip. *South. M. J.*, Oct., 1950, *43*, 848–851.

The purpose of the short article is to present 100 cases of trochanteric fractures of the hip and to discuss some of the surgical considerations in the commonest form of treatment employed, the use of the Austin Moore blade-plate.

The greater portion of the patients were in the seventh, eighth and ninth decades of life, the average being 70.7 years.

The mortality rate for the 73 cases treated surgically by some form of internal fixation was 11 per cent. As mentioned above, the most common type of fixation was with the Austin Moore blade-plate. In 6 of the cases, the Smith-Petersen nail was used. Other methods of internal fixation are listed in a table. In 23 of the cases more conservative measures were employed. The Roger-Anderson well-leg-traction was used in 16 of these cases. Other methods included traction and plaster casts.

Before roentgenograms are taken to check the position of the fragments, a towel clip is placed in the skin ½ inch distal and lateral to the point where the femoral artery crosses Poupart's ligament. This procedure usually puts the towel clip over the femoral head on the roentgenogram. The localization of the femoral head is helpful in placing the blade-plate in the trochanteric fracture.

The operative procedure and the method of applying the Austin Moore blade-plate are discussed in some detail.—*J. G. Snead, M.D.*

MANNING, HARRY J. Symptomatic hemangioma of the spine. *Radiology*, Jan., 1951, *56*, 58–65.

Hemangioma of the vertebra has been found in approximately 10 per cent of routine autopsy examinations of spinal columns. Most of the patients present no clinical symptoms and the lesion is usually an incidental roentgen finding. When symptoms do occur they vary widely, depending upon the cord level and the extent of the osseous lesion.

The roentgenographic picture is a reduction in bone density between parallel vertical trabeculae which are increased in density.

When hemangioma of the vertebra produces symptoms, irradiation is the primary form of therapy The dosage is determined by individual clinical response. Repeated courses are usually necessary to effect recovery or improvement.

Surgery may be necessary in event of sudden spinal cord compression by the tumor, but radiation

therapy should always follow laminectomy.—*E. E. Seedorf, M.D.*

Titze, Alois. Ueber komplette Querschnittslähmungen nach frischen Wirbelbrüchen. (Complete transection paralysis following fresh fractures of the vertebra.) *Wien. klin. Wchnschr.*, Jan. 19, 1951, *63*, 46–49.

The incidence of transection paralysis in fractures and dislocations of the spine varies from 15 to 40 per cent. It is desirable not only from the prognostic but also from the therapeutic standpoint to know within the first hours following the accident which patients have complete and which have only a partial paralysis. This is important because those cases that are not entirely hopeless neurologically must be relieved from pressure upon the spinal cord immediately, while in those with irreparably damaged cords such consideration is not necessary.

A complete paralysis is present when motion and sensation are symmetrically absent below the site of the lesion of the spinal cord. Complete absence of reflexes and paralysis of the bladder and rectum also have to be present. If minimal sensation only is present or one reflex is positive, the paralysis is not complete.

A roentgenological examination can be very helpful in the early diagnosis. If there is a displacement of the cephalad portion of the spine anteriorly for more than one-third in the thoracic and lumbar region and more than one-half in the cervical region the cord is definitely and completely severed.

A complete transection paralysis can never improve, in contrast to a partial paralysis which can do so considerably. It is therefore not necessary to reduce a fracture or dislocation if the cord is completely severed. It is also contraindicated to place a patient with complete paralysis in a plaster cast which often is the cause for a decubitus, the most serious and dangerous complication in such patients.—*H. P. Mueller, M.D.*

Chambers, Cyril H. Congenital anomalies of the tarsal navicular with particular reference to calcaneo-navicular coalition. *Brit. J. Radiol.*, Oct., 1950, *23*, 580–586.

Although calcaneo-navicular coalition has been described as an unusual condition, it has been seen not uncommonly in clinics where routine oblique views are included in examination of the foot. This coalition can exist in various degrees varying between a cartilaginous or fibrous bar to a complete bony bar. The most likely basis for the development of this condition is the existence of a small accessory tarsal bone in this region. In a high percentage of cases with some degree of calcaneo-navicular coalition there is associated spasmodic flat foot, and it has been claimed that in 25 per cent of patients with spasmodic flat foot there is some skeletal abnormality.

A second anomaly, which, when present, is more frequently associated with peroneal spastic flat foot, is fusion between the talus and the calcaneus. This is seen best in the oblique posteroplantar view. Since the condition is very frequently associated with lipping of the dorsal margins of the talus and navicular, such lipping should indicate the necessity for the special views.

Synostosis between the talus and navicular is a much rarer situation, and it is easily recognized in dorsoplantar or lateral views. Other rare anomalies are fusion of the navicular and cuboid, absent cuboid, bipartite navicular, and Pirie's ossicle, or dorsal talonavicular ossicle. The existence of an ostibiale externum is a common finding.—*E. F. Lang, M.D.*

Jakob, A. Ein Beitrag zur Differentialdiagnose der enossalen Verkalkung, insbesondere des Knocheninfarkts. (The differential diagnosis of endosteal calcification, with particular reference to bone infarcts.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Jan., 1951, *74*, 77–83.

Although long known by pathologists, bone infarcts are seldom demonstrated roentgenologically, as a rule by accident, and then usually misdiagnosed. They are most frequent near the ends of the long bones, are painless, and if small may be rapidly replaced by bone, and hence be unrecognizable. Larger ones take considerable time to calcify to the point of roentgenological demonstrability. Pathologically verified cases are rare because autopsy and operation on bone are not frequently done. They may be misinterpreted as calcified enchondromas, calcified parasites, central osteomyelitis, degenerating cartilaginous rests, sclerosing osteogenic sarcoma, or osteoblastic metastases.

Six cases of endosteal calcification, 2 of which were pathologically verified, are reported. The verified cases had a calcified enchondroma of the femur, and bilateral calcified gummas involving most of the lower half of each femoral shaft. The other cases were diagnosed as enchondroma of the ischium in 1 instance and as bone infarcts in the other 3 instances. Of these latter, in 1 the bone infarct occurred in association with an old healed fracture of the femur, in another in the upper portion of the tibia in association with arthritis deformans of the knee joint, and in the third as a solitary lesion of a femur.—*J. J. B. Light, M.D.*

Blood and Lymph System

Griffiths, I. H. A preliminary report on abdominal aortography in urology. *Brit. J. Urol.*, Dec., 1950, *22*, 281–303.

The object of this paper is to present a report on a

short and critical study of abdominal aortography, not with any attempt to press another method of investigation but to draw attention to its possibilities as an adjunct to other diagnostic procedures. It is a preliminary report, since it is based on a series of only 25 cases and only a small variety of lesions have been investigated so far. However, many interesting facts and much important information have already been obtained from this limited study.

The dangers associated with vascular puncture of a thick-walled vessel such as the aorta are remote. Extravasation of blood probably does occur, but the valvular effect of the oblique passage ensures rapid closure following withdrawal of the needle.

Reaction to iodine is a possibility even when using diodone, but its incidence is no higher than when using diodone for intravenous pyelography. In this present series iodism has not occurred. In 2 cases diodone was injected inadvertently into the periaortic tissues but without any ill effect. Roentgenograms made one hour later demonstrated that the diodone had been completely absorbed. It cannot be predicted at this moment that aortography will share the same merit as pyelography, but it is anticipated that it will be more generally employed as a diagnostic adjunct.

The interpretation of aortograms is discussed, and some indication given where this investigation may usefully be employed.

The contrast material used is a 70 per cent solution of diodone. The eighteen large roentgenographic reproductions are unusually clear and well described.—*E. J. McDonald, M.D.*

Milanes, Bernardo, Stables, Eliseo Perez, and Lastra, Jose S. Observations on chronic obstruction of the abdominal aorta; Leriche's syndrome. *Surgery*, Oct., 1950, *28*, 684–698.

The association of pathologic changes in the aorta with peripheral vascular disturbances was observed in 13 cases in which chronic obstruction of the aorta was demonstrated by abdominal aortography. The symptoms presented in these cases were similar to those attributed to the syndrome described by Leriche. They included coldness and weakness of the lower limbs, bilateral intermittent claudication and disturbances of erection. Physical findings included an absence of arterial pulsations of the iliac arteries and of the arteries of the lower extremities and muscular atrophy and loss of hair of the lower extremities. In advanced cases there may be ulceration and gangrene. The patients were between the ages of forty-nine and sixty-nine years and all but 2 were men. In 8 cases the blood pressure in the upper extremities was elevated.

The authors urge the use of aortography, especially that technique in which the medium is injected directly into the aorta through the back, because it provides the diagnosis and gives exact information concerning the location and extension of the obstruction as well as the status of the collateral circulation.

Necropsy was performed in 4 cases and in these, obliterating arteriosclerotic lesions of the iliac arteries with secondary thrombosis of the aorta were demonstrated. It is the authors' opinion "that aortic obstruction only develops following bilateral iliac obstruction." When only one iliac artery was obstructed the aorta was always found to be patent.

It is concluded that medical treatment is ineffective in this condition. Bilateral lumbar sympathectomy associated in 4 instances with aorto-iliac resection resulted in at least temporary improvement in most cases.

Each of the 13 cases is reported in detail and 10 representative abdominal aortograms are reproduced. Three illustrations show the appearance of thrombosis of the aorta and of the iliac arteries.—*C. B. Holman, M.D.*

Guilhem, P., Baux, R., Fournie, J., and Paille, J. Exploration radiologique des veines du bassin chez la femme. (Roentgen examination of the veins of the pelvis in women.) *Gynéc. et obst.*, 1950, pp. 432–442.

Following Drasnar's intramedullary perfusion of contrast material, the authors studied the innocuousness of such transosseous injections and report their technique and results of phlebography of the female pelvis. Their technique consists of injecting 20 cc. of radiopaque organic iodine solution (diodonne 50 per cent) in ten seconds into the intramedullary space. For this they use a strong needle 5 cm. long and adapted with a stylet. The site of the injections are the pubis (1 cm. below its upper border and 2 cm. lateral to its medial border), the ischium, the greater trochanter, the iliac crest and the sacrum, since these bones are spongy in nature. It is very important to aspirate blood into the syringe before injection as this is the only means by which one is sure that the end of the needle is in the intramedullary cavity.

The authors have obtained very fine visualization of the normal veins of the pelvis, especially those surrounding the uterus, by using a Picker type of apparatus with the following factors: 85 kv., 30 to 35 ma., and 1 to 1.5 sec. of exposure with a moving grid and a focal distance of 80 cm. They recommend this technique as a valuable means of ascertaining phlebothrombosis and other pathology in the veins of the pelvis.—*J. N. Sarian, M.D.*

Scala, Dino A. L'arteriografia distrettuale nelle affezioni vascolari degli arti. (Regional arteriography in vascular lesions of the limbs.) *Radiol. med.*, Jan., 1951, *37*, 1–11.

Two conditions must be fulfilled to obtain satisfactory arteriograms for the demonstration of vascu-

lar alterations in the limbs: (a) the entire extent of the distribution of the affected vessel must be visualized, and (b) the method must be without danger to the patient.

The author, in collaboration with Dr. Enria of the Surgical Clinic, has performed regional arteriography of the limbs in more than 100 cases at the Institute of Radiology of the University of Torino. The opaque media employed included diodon, diodone, diodrast, joduron, nosidrast, umbradil, tenebril and in a few instances thorotrast. The technique of injection is described in detail. It consisted in injecting the opaque medium transcutaneously with the aid of a needle-cannula 6 to 8 mm. in diameter. This was attached to a self-made apparatus controlling the speed and pressure of injection. The author mentions that more complex apparatus, which also permits an automatic control of the intra-arterial pressure, are now being used by several investigators, among them Bazy.

The injection was made with the circulation free rather than blocked since such procedure is more physiologic and gives a truer image of the actual status of the circulation. The speed of passage of the opaque medium from the arteries through the capillaries into the veins was determined from successive roentgenograms taken at intervals of a few seconds. For this purpose the author has at his disposal a seriograph which permits the rapid successive exposure of 3 to 6 films of 24 by 90 cm. in size, thus making possible not only a good serial visualization of the circulation but also the demonstration of large regions or even the whole extent of the distribution of the affected vessel on the same film.

The author discusses the diagnostic value of regional arteriography in (1) Buerger's disease, (2) lues, (3) arteriosclerosis, (4) diabetic gangrene and (5) arterial emboli, and reproduces samples of beautiful roentgenograms to illustrate the salient points of differentiation.

The method is also useful in the diagnosis of traumatic alterations, aneurysms and frostbite. It has been further employed in the study of the Volkmann syndrome and of the vasomotor syndromes (Reynaud's disease), in the differentiation of bone tumors and finally, as an auxiliary procedure to phlebography in the roentgen visualization of lesions of the veins.

The author concludes by stating that regional arteriography, with the above described technique, often constitutes the sole means for the accurate demonstration of anatomopathologic and physiopathologic changes of the arteries and of the circulation. It contributes not only to the diagnosis and prognosis, but also to the establishment of more precise therapeutic indications in various angiopathies. —*T. Leucutia, M.D.*

Portmann, U. V., and Robinson, W. H. Lymphatic leukemia occurring simultaneously in Negro brother and sister. *Cleveland Clin. Quart.*, Jan., 1951, *18*, 33–34.

The authors report leukemia occurring simultaneously in a Negro brother and sister (40 years and 41 years of age). Both of them died. The report is made because of the rarity of leukemia in more than one member of a family and the extremely low incidence of the disease in the Negro race. A review of the literature revealed no evidence of hereditary factors of importance in leukemia.—*F. M. Windrow, M.D.*

General

VandenBerg, Henry J. Can cancer be an inherited family disease? *J. Michigan M. Soc.*, Oct., 1950, *49*, 1185–1187.

This paper reports the occurrence of bilateral breast carcinoma in a mother and two daughters wherein the sequence and location of the carcinomatous growths were identical. A grand-daughter of the original case now has a breast carcinoma in the same breast and same location as the first carcinoma of her predecessors.

The author reviews in his discussion the evidence of hereditary factors in neoplastic disease and cites these cases as evidence in support of the probable genetic origin of cancer.—*Robert Emerick, M.D.*

Büttner, A., and Paul, K. Ein Beitrag zur Behandlung örtlicher Thorotrastschäden. (Treatment of localized damage due to thorotrast.) *Chirurg*, Dec., 1950, *21*, 683–687.

The authors discuss local tissue damage as the result of thorotrast injection, namely, thorotrast granuloma. This damage can occur by extravasation around a vein, and also, when an attempt is made to outline the liver and spleen, by using large quantities of the thorotrast which becomes concentrated in the said organs.

The authors' 2 cases occurred after perivascular extravasation. In 1 patient, a swelling in the antecubital area was noted three years after the injection into an exposed vein. Eleven years after the injection, there was no gross change in the swelling, clinically or roentgenologically. There was no evidence of liver or spleen damage. The sternal puncture was normal as was the peripheral blood. The Geiger-Müller count over the involved area was double of the normal.

The second patient noted a swelling in the antecubital space one-half year after the injection. Five years after the injection, clinical and laboratory studies were completely normal (thorotrast material could be demonstrated roentgenologically). The Geiger-Müller count was again doubled. Operative removal was done and healing was not disturbed. Considerable fibrosis and hyalinization of the blood vessels were noted. The changes were present in the

wall but not in the intima of the artery. In the oldest areas, regressive changes with necrosis and calcification occurred. Inflammatory cells, particularly granulocytes and lymphocytes, were absent.

The great danger of thorotrast tissue damage is cancer formation. Regardless of whether this occurs secondary to radiation induced mutation or through pathological regeneration, one thing is certain: the radiation cancer arises only in the bed of radiation damaged tissues. A cancer secondary to radiation has never been observed in normal skin. Of 243 cases of radiation cancer reported by Gruetzmacher in 1943, all had originated in radiation injured skin. In one-half of these, a radiation ulcer had been present. It remains to be seen whether the radiation energy producing a thorotrast granuloma can produce chronic radiation damage.

The authors calculated that 1 mg. of thorium produces an ionization in 1 cc. of tissue, corresponding to 0.25 r per day. In the most favorable case, that is, when there is a homogeneous distribution of the thorium, an amount of 30 mg. of thorium in 1 cc. of tissue yields 7.4 r per day. If the distribution is not homogeneous, 30 mg. of thorium delivers 85 r per day in a tissue volume of 14.6 cc. The authors believe that the necrosis produced in the thorotrast granuloma is due to radiation, the effect being primarily a result of the alpha particles. McMahon has reported a case of thorium sarcoma of the liver, Zollinger a case of sarcoma of the kidney, sixteen years after thorotrast pyelography, and Rudolphi a case of carcinoma of the lacrimal sac after injection of the thorotrast into that part. Instances of anemia, cirrhosis of the liver, etc., have also been recorded in the literature.

Bauer objects to operative removal of the thorotrast granuloma because of damage to the tissues and also since it is impossible to remove all of the thorotrast. However, those areas having the greatest concentration of thorotrast can be removed, thus decreasing the radiation dose to the tissues. Granuloma in the neck and axilla are inoperable for technical reasons, although recently, partial resection has been done in America.—*Samuel Richman, M.D.*

Moore, Moore, Jr., and Clarke, Charles L. Extreme calcinosis interstitialis; report of a case. *South. M. J.*, Oct., 1950, *43*, 861–863.

The authors report an unusual case in which all types of calcification ranging from isolated deposits along the tendon insertions and in the ligaments to massive tumoral calcinosis occurred.

The etiology of this condition has not been established. According to one theory the calcium is deposited in degenerated connective tissue. Another theory postulates an altered calcium metabolism.

Calcinosis or chalk gout occurs in several forms variously described as calcinosis circumstripta, calcinosis universalis, tendino-fascitia calcarea rheumatica, Raynaud's disease with calcareous degeneration and tumoral calcinosis.

The universal type usually occurs in the first two decades of life and involves skin, subcutaneous tissue and sometimes interstitial tendon tissue, nerve sheaths, muscles and fascial planes. Prognosis is poor and no therapy has been successful. The circumscribed variety is commonly seen in older people and predominantly in women. In about 50 per cent of the cases it is associated with vasospastic disease such as Raynaud's disease, scleroderma or sclerodactylia. This type usually discharges and heals spontaneously. The tumoral form presents a very large mass, frequently in the gluteal or deltoid region, and at first may resemble a tumor.

The case presented seemed to have some manifestations of all types. A detailed description is given with extensive laboratory findings.—*J. G. Snead, M.D.*

RADIATION THERAPY

Friedberg, Volker. Die Behandlung des Röntgenkaters mit "Avil." (Treatment of radiation sickness with "avil.") *Strahlentherapie*, 1951, *84*, 157–159.

On the basis that radiation sickness is comparable with allergic reactions and that histamine-effect could be produced purely from cell destruction, antihistaminic drugs were used in the treatment of radiation sickness. All antihistaminic drugs do not have the same effect.

"Avil" (an antihistaminic drug previously listed as 513c, Fabwerke Höchst) was used in daily subcutaneous doses of 100 mg. in the treatment of 42 patients with slight to severe radiation sickness. Symptoms disappeared with impressive rapidity. Untoward effects were absent. Control injections of physiologic saline failed to relieve the symptoms.—*H. G. Moehring, M.D.*

Lutterbeck, Eugene F., and Hummon, Irvin F. Uniform contact roentgen therapy for large areas; a simple device and method. *Radiology*, Jan., 1951, *56*, 108–111.

In order to use contact roentgen therapy for large thin lesions, both benign and malignant, a grid containing squares measuring 1.5 by 1.5 cm. was devised. This grid consists of a sheet of lead, 22 by 22 cm., aperture in the center measuring 18 cm. on a side. A square net is fashioned from a nylon fishing line with the meshes 1.5 cm. square. This net is firmly attached to the sides of the aperture in the lead sheet.

In practice, the area to be treated is outlined by lead foil and over this is placed the grid. Over this is placed a third thin piece of lead about 10 cm. square with an aperture measuring 1.5 by 1.5 cm. This lead piece with the 1.5 cm. square aperture is placed over successive meshes of the grid, and the desired roent-

gen dose is delivered to each area.—*E. M. Cooper, M.D.*

Murphy, Walter T., and Reinhard, M. C. Some observations with 1,000-kv., 400-kv., and 200-kv. x-ray therapy. *Radiology*, Oct., 1950, *55*, 477–493.

Observations made during the course of routine treatment of malignant neoplasms by radiation of three different qualities, namely 9.0, 5.0, and 0.9 mm. half-value layer of copper, are reported. Discussion is divided into five topics.

1. Curves are presented showing treatment time—skin dose relationship for 200, 400, and 1,000 kv. radiation. From these curves it is evident that for any treatment period there is no significant difference in the skin dosage delivered by the three qualities of radiation.

2. Effect of increment and time spacing on skin and subcutaneous tissue is evaluated. Patients treated with small daily increments through four ports per day showed less immediate and late skin and subcutaneous reactions than those treated with a technique in which each of four ports received a larger increment every fourth day. Total treatment time and dosage were the same in the two groups. The late changes when large increments were used, were more severe and pronounced with the 200 kv. radiation than with the 400 or 1,000 kv. radiation.

3. Comparison of skin and subcutaneous reactions produced in the same patient by 200 kv. and 1,000 kv. showed that, for equal total dose and equal treatment time, the immediate reactions were similar in a large percentage of the patients. The 200 kv. radiation produced a greater number of late skin and subcutaneous reactions than did the 1,000 kv. radiation.

4. Tissue doses at depth as a function of the treatment time for the three qualities of radiation are presented graphically. Associated with the increased depth doses of the higher qualities is an increase in the number of bladder and rectal complications.

5. Clinical end-results following irradiation of cervical carcinoma showed the advantage of 1,000 kv. over 200 kv. radiations, especially in large patients. A selected group of Stage II and Stage III cases showed a three year controlled disease percentage of 58.5 for 1,000 kv. and 45.6 for 200 kv. radiation.—*A. W. Sommer, M.D.*

Green, Anthony, and Jennings, W. Alan. New techniques in radium and radon therapy. *J. Faculty of Radiologists*, Jan., 1951, *2*, 206–223.

The authors describe various techniques for the application of radium and radon. The techniques for radium are based on the use of the Paterson and Parker tables. The object of the authors is to ensure the precise implantation of the various radium sources within or without a lesion, and also to make the most efficient use of a limited stock of radium. Essentially the technique consists in the preparation and use of (1) a number of small independent radium cells ranging from 1 to 5 mg. radium in intensity for lengths of 0.5 to 1.0 cm., (2) a series of hollow sheath needles from 1 to 12 cm. in length into which the cells are loaded, and (3) external stabilizer attachments. The first two factors enable one to prepare needles of appropriate length and linear density. This is amply illustrated by diagrams and radioautographs. The problem of end-loading with double intensity cells, i.e., 1 mg. per 0.5 cm. instead of 1 mg. per 1 cm., for conditions where a cross needle at the end of a series of parallel needles cannot be inserted, is well demonstrated. To obviate the risk of error when employing small cells, the use of blank spacers between the active cells as a means of varying the linear concentration was adopted. For example, when cells of 1 cm. length are used, the placing of 0.5 cm. spacers in the inner needles of an implant automatically reduces the linear concentration to two-thirds that of the fully loaded outer ones. The choice of dimensions is determined by the needle-isodoses produced, the zone of uniformity being achieved at a distance of 5 mm. from an implant plane of needles 1 cm. apart.

The third factor was embodied in the use of a material called "perspex" (a plastic material composed of polymethyl methacrylate, commonly called "lucite") which can be readily machined or cut. The positioning technique of the interstitial needles is carefully worked out beforehand, and the necessary contours and holes for the insertion of the needles are made into the material. It was noted that for each contour or lesion a new stabilizer must be made, but the authors obviate this by keeping a sufficient number of forms in stock. With some ingenuity on the part of the operator one may adapt a previous form to each new case. The use of the stabilizer gives one the feeling of some security in that the various implanted needles remain in a fixed relationship to each other throughout the course of treatment.

Details of filtration and the needle sheath adopted are shown. Monel metal tubing is used throughout in preference to platinum as the platinum was found to be unsatisfactory beyond lengths of 4.0 cm., equivalent filtration being that of 0.5 mm. platinum. The various lengths of needles used and the technique of loading are discussed in detail. A depth dose chart comparing the use of plaque-implant technique to external irradiation is presented.

The indications for use of stabilization of needles are listed, which is dependent upon the accessibility of the lesion and the ingenuity of the radiologist.

Radon techniques employing seed chains are also well demonstrated. These techniques were evolved as a complement to the stabilized radium methods. The authors utilize the gold seeds, which are loaded into a starched silk sheath, maintaining the position

of the seeds by treating the termination of the sheath with a coating of cellulose acetate dissolved in acetone. Their position is determined without handling, by staining the loaded portion with gentian violet. The sheath is treated with water repellant silicone to prevent its staining by blood. Where it is not always possible to determine the precise length of chains required until at the time of surgery, a string of gold seeds, much like a string of sausages is used, from which desired lengths can be cut and inserted. This involves the use of blank spacers and marking of the seed positions with gentian violet for obvious reasons.

Methods of insertion of the seed chains are discussed. Curved and straight trocars with cannulas having been designed and made for the purpose of applying the seed-chain technique are illustrated.

Throughout the article there are adequate roentgenograms showing examples of the various applicators and stabilizers in situ.—*L. Lemak, M.D.*

Duffy, B. J., Jr., and Fitzgerald, P. J. Cancer of the thyroid in children; a report of 28 cases. *J. Clin. Endocrinol.*, Oct., 1950, *10*, 1296–1308.

Cancer of the thyroid in children is a serious disease. In all but 2 out of 28 patients presented by the authors metastases were found in the cervical lymph nodes. Pulmonary metastases were present in 13 patients, but no skeletal metastases were found. Treatment was by complete thyroidectomy and neck dissection. Postoperative irradiation was given to 4 patients. To date there have been 2 deaths among the 28 patients. However, since only 6 of these patients have been followed for ten years or more, the authors feel unprepared to discuss the effects of treatment on this disease.

The histopathologic types of carcinoma were: papillary, 15 patients; alveolar and follicular, 8 patients; solid, 4 patients; and unclassified, 1 patient. The age of onset was correlated with puberty in 25 patients. The initial sign of the disease in 26 of the 28 patients was the appearance of one or more enlarged cervical lymph nodes with or without nodular enlargement of the thyroid. Cancer of the thyroid should always be considered in the differential diagnosis of "lumps" in the neck in children.

Roentgenograms of the chest of the patients with pulmonary metastases revealed a diffuse miliary to nodular involvement affecting primarily the basilar portions of the lungs. Large solitary lesions were rarely seen in this series of patients. There was no significant difference in the roentgenographic appearance of pulmonary metastases from the different histopathologic types of thyroid cancer. In 2 patients a diagnosis of tuberculosis was made from the chest roentgenogram, and in another patient histoplasmosis was diagnosed.

Only 1 patient came from an endemic goiter area, and only 2 gave a family history of thyroid disease.

It is of interest to note that 9 patients had been given low voltage roentgen therapy for "enlarged thymus" between the fourth and the eighteenth months of life. The authors believe that a cause and effect relationship between thymic irradiation and the development of cancer would be quite unjustified on the basis of the data at hand. However, the potential carcinogenic effect of irradiation is becoming more and more apparent and such relationship as that of thymic irradiation in early life and the subsequent development of thyroid or thymic tumors might be investigated with benefit.—*F. J. Rigos, M.D.*

Frank, Ralph C., and Pohle, Ernst A. Late radiation reaction in the small intestine manifest eight years after therapy; report of a case. *Ann. Surg.*, Jan., 1951, *133*, 104–108.

The authors report a patient with late radiation reaction of the small intestine requiring surgical resection eight years after the initial finding of an adenocarcinoma of the colon which had been removed. The pathological changes found in the small intestine were similar to those described by other authors. Two years prior to the appearance of the late radiation reaction of the small intestine, the patient also had a metastatic mass of the anterior peritoneum excised.

The authors rightfully conclude that although radiation reaction of the small intestine should be considered whenever radiation therapy is administered to areas overlying portions of the bowel, the fear of producing such radiation changes should not interfere with the indicated treatment. It is pointed out, however, that the radiation therapy must be administered with safe total doses.—*Moris Horwitz, M.D.*

Amory, Harold I., and Brick, Irving B. Irradiation damage of the intestines following 1,000-kv. roentgen therapy; evaluation of tolerance dose. *Radiology*, Jan., 1951, *56*, 49–57.

The authors report the effects of 1,000 kv. irradiation on the small and large intestine in a group of 20 male patients with testicular tumor with or without retroperitoneal lymph node metastases.

The series is divided into three groups: those with roentgen findings of severe damage, those with moderate damage, and those with only mild intestinal damage. A correlation of the roentgen findings and autopsy results is presented.

It is concluded that the small and large intestine of the adult male can tolerate a depth dose of 4,500 r of 1,000 kv. radiation in fifty-four days delivered through moderate sized portals.—*E. E. Seedorf, M.D.*

Hays, Robert A., and Portmann, U. V. Carcinoma of the cervix; trends in treatment. *Cleveland Clin. Quart.*, Oct., 1950, *17*, 242–251.

This is a general summary of the present day treatment of cancer of the cervix.

The authors present the classification of the League of Nations and note that clinical classification has more bearing on prognosis than pathologic grading of the tumor. They report that 80 per cent of patients when first seen have extension beyond the cervix. The average age of patients with preinvasive cancer is 36.6 years and for those with grossly detectable cancer 44.2 years.

Hays and Portmann prefer preliminary external roentgen therapy because

1. Malignant cells which might be disseminated by manipulation are devitalized.
2. Lymphatics are partially sealed.
3. Local infection is diminished.
4. Shrinkage of tumor restores anatomic relationships.
5. Five to 10 per cent increase is obtained in five year survival, particularly in advanced cases.

They give 1,000 r to the parametria and cervix and then radium is applied. The Ernst applicator is used if feasible, and the bladder and rectum are packed off with gauze impregnated with barium sulfate. With this method 8,640 mg. hr. are delivered in two applications. When this applicator cannot be used a modification of the Manchester method is employed. The use of radium needles is briefly reviewed.

Following radium therapy another course of roentgen therapy delivers 3,000 to 3,500 r to the parametria through split anterior and posterior fields.

The use of intravaginal irradiation is advocated to supplement external irradiation in carcinoma of the cervical stump or recurrence following radium.

Surgery may be done in Stage I and early Stage II in suitable patients as advocated by Meigs and Taussig.

Five year results with surgery and irradiation are briefly compared but no positive conclusions are drawn from these figures. In suitable cases it would appear that irradiation followed in two to three months by iliac lymphadenectomy may improve results.—*Martha E. Mottram, M.D.*

Barry, A. P. Carcinoma of uterine cervix: the need for combined radiation and surgical treatment. *Irish J. M. Sc.*, Jan., 1951, *6*, 15–21.

The author states that with modern radiation therapy alone 60 per cent of patients with carcinoma of the cervix die. He raises the question as to whether or not everything possible is being done for these patients. Gluxman and Stanley Way, of Newcastle, state that 68 per cent of their cases in which a radical operation was done showed lymph node involvement. These were Stage I and Stage II carcinomas of the cervix. He states that irradiation cannot cure these patients. Many cases who die show that the carcinoma is still confined to the pelvis at the time of death. Twenty-seven per cent of these deaths were due primarily to uremia following obstruction of the ureters and 38 per cent were due to pelvic infections. Many of these could be salvaged by adequate surgery, he believes. He gives five indications for surgery in carcinoma of the cervix:

(1) Radioresistant lesion, proved clinically or cytologically.
(2) Columnar cell type carcinoma.
(3) Large fibroids, ovarian tumors or salpingitis.
(4) Vaginal vault stenosis.
(5) Refusal of irradiation and pregnancy.

Three cases are presented:

Case 1. Adenocarcinoma, clinical Grade 2. Patient's age, forty-nine years. Radiation therapy was given in May, 1950, and a Wertheim-Bonney hysterectomy was done on July 16, 1950. A few tiny islets of cells were suggestive of residual carcinoma in the operative specimen. No carcinomatous lymph nodes were found. The patient was doing well on the sixteenth postoperative day.

Case 2. Aged forty-two. Epidermoid carcinoma, clinical Grade 2. Irradiation was given in March, 1950. A Wertheim-Bonney hysterectomy was done December 4, 1950. Numerous pelvic lymph nodes contained carcinoma. The cervix contained no carcinoma. The patient was doing well on the twentieth postoperative day.

Case 3. Aged forty-seven. Epidermoid carcinoma, clinical Grade 4. Partial ureteral obstruction and involvement of the bladder. In late October, 1950, a pelvic exenteration, including all of the pelvic organs except the rectum, was done. The ureters were transplanted into the colon. The patient had a fairly stormy course, but was in good condition at the time she was discharged from the hospital on November 12, 1950.

This paper was presented in an attempt to stimulate more interest in the combined use of irradiation and surgery on the problem of carcinoma of the cervix.—*F. M. Windrow, M.D.*

Frowein, K. R., and Fahrenkamp K. Die Behandlung des Strahlenkaters mit intravenösen Novokaingaben. (Treatment of radiation sickness with intravenous administration of novocain.) *Strahlentherapie*, 1950, *83*, 70–72.

On the assumption that novocain would inhibit a hypothetic, radiation-induced "hyperergic" state of the nervous system, a novocain and honey preparation was administered intravenously in patients with radiation sickness. Fifty patients were treated: 74

per cent became symptom-free, 22 per cent were considerably improved, and 4 per cent were unaffected. No untoward effects were noted.

The diarrhea which accompanies radiation therapy of the pelvis was unaffected by this treatment.—*H. G. Moehring, M.D.*

HEIDELMANN, GERHARD. Die Behandlung der Brachialgia paraesthetica nocturna durch Röntgenbestrahlungen des vegetativen Nervensystems. (The treatment of brachialgia paraesthetica nocturna by roentgen irradiation of the vegetative nervous system.) *Med. Welt.*, Feb. 3, 1951, *20*, 148–150.

The author describes under the above mentioned name a condition which he considers a separate clinical entity, and which was first reported by Schulte in 1947. It is observed mostly in women about the time of the menopause and consists of the appearance, after several hours of normal sleep, of pain and paresthesia in the hands which make further sleep impossible. During the day, the symptoms disappear except when the hands are exposed to cold.

Treatment consisted of the application of 150 to 200 r to one posterior cervical and one posterior upper thoracic field of 15 by 10 cm. to one right and one left supraclavicular and one right and one left axillary field of 10 by 10 cm. each, with 180 kv., 0.5 mm. Cu filtration, and 15 ma. at a focus skin distance of 40 cm. Two series in two consecutive weeks were given. Fifteen of the 16 patients treated improved markedly after the first two series. A third series after another week and a fourth after three to six months may be given if complaints persist. In all except one of the treated patients a satisfactory result was obtained. Following the first treatment, an exacerbation of the symptoms not infrequently occurred; the analgesic effects appeared only in the second or third week.—*K. E. Matzinger, M.D.*

GUZMÁN, LEONARDO. Cáncer de la lengua. (Cancer of the tongue.) *Radiología*, Panamá, Dec., 1950, *1*, 9–24.

Da Costa states that cancer of the tongue represents 8 per cent of all cancers in the male, while Stevenson cites the figure of 7.5 per cent. In Chile the incidence is considerably lower. Of 13,073 patients observed at the National Institute of Radium up to the end of 1948, 130 had carcinoma of the tongue, giving a percentage of 0.99.

The author analyzes in detail the clinical aspects, the methods of treatment and the end results in this group of 130 patients.

In only 16 instances (13.1 per cent) was the carcinoma local. The remainder had extensive regional metastases: 44 per cent to the carotid region, 20 per cent to the submaxillary region, 22 per cent to the submaxillary and carotid regions and 9 per cent to both sides of the neck. The primary carcinoma involved the tip of the tongue in 3 cases, the borders in 24 cases, the anterior half of the dorsum in 28 cases, the posterior half of the dorsum in 31 cases, the base in 31 cases, and the floor of the mouth in 13 cases. Of the 130 patients, 111 were men and 19 women. The age distribution varied between fourteen years and the ninth decade of life, the vast majority of the patients being in the advanced age groups.

The treatment of the primary lesion consisted of interstitial application of radium, external roentgen therapy, or a combination of both. The regional metastases were removed surgically whenever possible, otherwise they, too, were treated by external roentgen therapy or radium molds. As a follower of the French school, the author uses the eight day technique for the interstitial implantation of the radium needles and the long protracted method with large total doses for external roentgen therapy. Details of the procedure are given for both agents. It is stressed that removal of all irritating foci and the institution of a thorough mouth hygiene must precede any form of treatment.

The results compare favorably with those of other institutions. Of 31 patients treated with radium alone, 19.3 per cent survived the five year period and 29 per cent lived four years or longer. In a group of 42 private patients (not analyzed in the present article) who were similarly treated, the author obtained a five year survival rate of 47.5 per cent. Of 14 patients treated with roentgen therapy alone, 14.2 per cent were cured five years or longer.

In concluding, the author emphasizes the necessity of biopsy in all ulcerative lesions, hypertrophic excrescences and leukoplakias of the mouth. No treatment of any kind should be undertaken without previous biopsy.—*T. Leucutia, M.D.*

JACOBSSON, FOLKE. Carcinoma of the hypopharynx; clinical study of 322 cases, treated at Radiumhemmet from 1939 to 1947. *Acta radiol.*, Jan., 1951, *35*, 1–21.

Predisposing factors. Sideropenia (the Plummer-Vinson syndrome), misuse of alcohol and heavy smoking.

Duration and diagnosis. In about one-third of the patients the duration of symptoms was more than six months. Most of the men had a long previous history of pharyngitis and the women, sideropenic dysphagia. Diagnosis of a carcinoma in the upper part of the hypopharynx is usually not difficult. However, tumors arising in the pyriform fossa cause few symptoms and diagnosis is therefore late and difficult. In many cases a metastatic node beneath the angle of the jaw was the first thing noticed. In one-sixth of the author's cases the tumor was not visualized on indirect laryngoscopy.

Site, size and extension of primary tumor. The tumor was more than 5 cm. in extent in 45 per cent

of the cases. A tumor length of 8–10 cm. was not unusual.

Metastases. Lymph node metastases were present in 54 per cent of the cases.

Treatment. A five year cure rate of 14 per cent with fractionated roentgen treatment has been obtained by the author. A cross-fire technique with four fields, two on each side of the neck, has been employed. A tumor dose of 5,700–6,000 r in about four weeks has been found optimum. Doses of 6,600 r or more in a month's time have resulted in fatal complications.

Treatment complications. (1) Acute edema and/or infections involving the mucous membranes sometimes occur. (2) Occasionally, symptoms which suggest a recurrence develop. In these instances increased thickness of the prevertebral shadow and an irregular contour of the mucosal lining may be demonstrated on roentgen examination. Direct endoscopy and biopsy will, however, reveal that the symptoms are due to edema and epithelitis and must be explained as a peculiar late irradiation reaction. These findings usually disappear after one to two months. It is most important that irradiation of a suspected recurrence should not be done before obtaining a biopsy. (3) In 13 of the author's cases symptoms of myelitis of the cervical cord developed and irradiation was considered the causative agent. (Since the author has instituted beam direction by fluoroscopic means thereby avoiding treatment over the spinal cord, myelodegeneration of the cord has not developed.)—*Mary Frances Vastine, M.D.*

Chris, S. Milton. Inflammatory carcinoma of the breast; report of 20 cases and review of the literature. *Brit. J. Surg.*, Oct., 1950, *38*, 163–174.

The author presents 20 carefully followed cases of inflammatory carcinoma of the breast. This unusual variety of mammary carcinoma has distinct clinical and pathological features. The primary type is defined as that clinical group of cases in which the inflammatory changes appear simultaneously with the carcinoma in an otherwise normal breast. The secondary type includes cases developing after mastectomy or with superimposed inflammatory spread on advanced carcinoma. These may arise in women of any age. The ages in this group range from forty-two to eighty-one. The writer supports the general opinion in the literature that inflammatory carcinoma of the breast is not specifically associated with pregnancy or lactation.

The characteristic signs of this disease are irregular blotchy redness with indurated edema of the skin and a hot, firm mass of tumor in the breast tissue. The regional lymph nodes are involved in a high percentage of the cases and distant metastases are present in approximately 15 per cent of the cases. The lesion may be confused with acute mastitis at first, but any breast inflammation which fails to respond to therapy in ten to fourteen days should be biopsied to rule out the presence of carcinoma.

There is great variability of the histopathological appearance in the inflammatory type of carcinoma of the breast. The spread is rapid and occurs via the subepidermal lymphatics. The author found no blood vessel invasion in these cases. The redness of the skin is related to dilatation of the minute subpapillary blood vessels, although the exact mechanism of this is difficult to explain.

The prognosis is extremely poor, with only 5 five year survivals reported in the world literature. The duration of life is not generally altered by any form of treatment. In this review, combinations of intensive irradiation, surgery, and hormone therapy were used with no cures at five years. The writer feels, however, that roentgen therapy is definitely indicated as good temporary palliation results locally and bone pain from metastases is significantly relieved.—*T. D. Allison, M.D.*

Saugmann-Jensen, Jørgen, and Jacoby, Paul. Cancer of the breast; results of treatment, 1929 to 1943. *Acta radiol.*, Dec., 1950, *34*, 453–468.

The writers report the results of treatment of cancer of the breast at the Radium Centre in Odense, Denmark, from 1929 to 1943 inclusive. Radical operation was done in 289 cases. After five years 40 per cent of these patients were alive. Preoperative and postoperative roentgen treatment was administered in 159 cases, while postoperative treatment only was given in 130 cases. Thirty-seven per cent of those patients receiving preoperative and postoperative irradiation were alive after five years and 42 per cent of those receiving postoperative irradiation only were alive after five years. Local recurrences occurred within five years in 11 per cent of the cases in which preoperative and postoperative treatment had been administered and in 17 per cent of the patients who had been given only postoperative treatment.

While 34 per cent remained free from symptoms for five years, only 18 per cent (of 145) had no recurrences for ten years—a fact which shows how little the result after five years can indicate the final result.

Forty-one patients were subjected to only a local operation and were given preoperative and postoperative or only postoperative irradiation as well. After five years 66 per cent were still alive as compared to 40 per cent who received radical operation. This number of cases is small but it conforms with the studies of other authors and so the question must be raised whether our present principles of treatment of cancer of the breast are the right ones.

In commenting on their study of cancer of the breast, the authors note that they did a radical or local operation on a total of 330 patients and they treated 159 pacients with roentgen rays only. After

five years 30 per cent of all these patients (489) were alive and 20 per cent were symptom free. When this result is compared with those obtained when treatment is purely surgical (according to the literature 30 per cent are alive after five years) no demonstrable effect from supplemental roentgen treatment is found.—*Mary Frances Vastine, M.D.*

THORNTON, WILLIAM N., JR., NOKES, JOHN M., and BROWN, DWIGHT J., JR. The evaluation of irradiation therapy for nonmalignant uterine bleeding at the University of Virginia Hospital. *Am. J. Obst. & Gynec.*, Jan., 1951, *61*, 75–79.

Three hundred and forty-eight cases of non-malignant uterine bleeding treated with radium or roentgen therapy (only 2 received roentgen therapy) from 1925 to 1948 are analyzed. The average age was 47.5 years, and since 1940 no patients under thirty-five years have been treated with irradiation.

The diagnosis at the time of treatment was menorrhagia with fibroma in 79 women, while the remainder had menorrhagia associated with an endometrium showing various normal phases, atrophy or hyperplasia; 74.1 per cent received a dose of 1,500 to 3,000 mg. hr. of radium and the rest smaller amounts. The average dose ranged from 2,001 to 2,500 mg. hr. The dosage has been gradually increased in the last decade since there was often recurrent bleeding with the use of small doses.

One hundred and seventy-eight (51.2 per cent) of the cases were followed six months to twenty-one years. Eight developed malignancy: 5 fundal, 1 ovarian, 1 cervical and 1 of unknown origin. The average time interval was 8.9 years after irradiation (range from 3 to 16 years) and the dose was 1,200 to 2,486 mg. hr. Twenty-six patients developed non-malignant complications or recurrent bleeding ten months to eleven years later. The amount of radiation in these cases varied from 800 to 2,400 mg. hr. Three patients had fibromas, 1 a dermoid and 1 an ovarian cyst. One patient received radium for undiagnosed pelvic tuberculosis and had widespread dissemination with death. Three patients had cervical stenosis and pyometria. The rest had recurrent bleeding without other complications.

The authors conclude that it is often difficult to determine which cases to select for irradiation and they reserve the method for patients with benign endometrial bleeding who have some contraindication to surgery.—*Martha E. Mottram, M.D.*

MILLEN, J. L. E. Results of treatment of bladder cancer by radiotherapy. *Brit. J. Urol.*, Dec., 1950, *22*, 430–433.

The results of treatment of 382 cases of cancer of the bladder at the Christie Hospital and Holt Radium Institute from the years 1932 to 1944 are discussed.

Of the 117 patients in whom radon seed implantation was used, there was a 63 per cent five year survival in those patients where there was no gross infiltration of the bladder wall and a 21 per cent five year survival in patients having gross bladder wall infiltration. The whole group of radon seed implantation showed a five year survival of 45 per cent.

Deep roentgen therapy was used in an attempt to cure 115 patients; 24 per cent of those having no gross bladder wall infiltration survived five years, but only 7 per cent of those with infiltration survived five years. In the group as a whole, 12 per cent survived the five years. Considering the advanced extent of the disease in the group treated by roentgen therapy, 12 per cent is a very satisfactory result.

Fifty-four patients were treated by other radical methods such as radium needle insertion and by contact roentgen therapy. The results were not satisfactory; only 11 per cent survived five years.

Ninety-six patients, or twenty-five per cent of the entire series were too far advanced for any form of therapy. Palliative small doses of roentgen therapy were given to 36 patients, but death occurred in an average of four months.

Of the whole group of 382 patients, 19 per cent survived five years or longer.—*W. M. Roy, M.D.*

GIBSON, J. M. W. Treatment of cancer of the bladder. *Brit. J. Urol.*, Dec., 1950, *22*, 424–429.

The author discusses the use of radiation therapy in treating cancer of the bladder. Radon seed implantation is employed where there is no appreciable spread beyond the bladder wall and the base of the tumor is not more than 6 cm. in diameter. Roentgen therapy is contraindicated for at least six weeks following suprapubic cystotomy, so a decision as to the method of treatment should be made before the bladder is opened.

Following removal of the projecting part of the tumor by diathermy, radon seeds are implanted to a depth of 0.5 cm. Each centimeter of tissue is calculated to receive a dose of 7,000 gamma roentgens. Roentgenograms are made with the seeds implanted and physicists, from this, calculate the dose received. All tumor cells up to 1 cm. beyond the level of the diathermy resection receive a lethal dose of radiation. Lesions which include the upper end of the urethra are not suitable for implantation. Calculus formation may be observed as a complication. Débris develop following the radiation reaction and unless passed with the urine, they may form the nuclei of calculi. Hematuria may also develop, usually about one year after treatment. It may be due to a recurrence of the lesion or to a late radiation reaction.

Roentgen therapy is used for patients in fair general condition and with tumors too advanced for treatment by other means. A 500 kv (peak) tube is employed, cross firing through six or seven small

fields around the pelvis, and giving a skin dose of 3,500 r and a tumor dose of 6,000 r. Radiation reaction is usually severe, particularly, since cases with ulceration and infection are subjected to roentgen therapy. It is often difficult to decide whether the ultimate relief will justify the increased discomfort produced by the roentgen therapy.

Roentgen therapy has also been used in the treatment of multiple papillomas, with complete disappearance of the lesions in some instances and moderate regression in others.—*W. M. Roy, M.D.*

Poole-Wilson, D. S. The treatment of carcinoma of the bladder. *Brit. J. Urol.*, Dec., 1950, *22*, 414–423.

Suprapubic cystotomy, diathermy destruction and the insertion of radon seeds is, when possible, the preferred method of treatment. Deep roentgen therapy is used in the more advanced stages of the disease.

In selecting the mode of treatment, it is advisable to determine the type of carcinoma and the amount of bladder wall infiltration present as well as the presence of metastases in the pelvic lymph nodes. Under general anesthesia, bimanual and cystoscopic examinations are made to determine the nature and extent of the disease. Intravenous pyelograms are made on all patients. Valuable information on kidney function can be obtained. Dilatation of a renal pelvis and ureter or the presence of a silent kidney indicates invasion of the trigone by tumor, and either partial or complete occlusion of a ureteric orifice. The bladder may show a tumor outlined by calcified debris on its surface and the presence of filling defects may help in the estimation of the size of the tumor.

Partial cystectomy is occasionally advisable for removal of tumors in the vault of the bladder or when a diverticulum complicates the tumor area. Partial cystectomy in the base of the bladder is generally unsatisfactory. Total cystectomy is used in patients where roentgen therapy has failed to destroy multiple superficial bladder lesions and in whom perurethral diathermy cannot control the recurrences, or where there has been recurrence at the site of a radon implant. The author even favors the use of open diathermy and radon seed implantation in the more advanced infiltrating type of carcinoma, as the primary lesion frequently remains quiescent and death results from secondary deposits elsewhere.—*W. M. Roy, M.D.*

Flocks, R. H. Treatment of patients with carcinoma of the bladder. *J.A.M.A.*, Feb. 3, 1951, *145*, 295–301.

The author has reviewed the treatment of 540 patients with carcinoma of the bladder seen between 1932 and 1942 in an attempt to revalue the indications and contraindications of the various types of therapy. He feels that the depth of penetration of the tumor into the bladder wall is a more reliable indication of metastasis than the microscopic anatomic structure or grade of malignancy. Extremely important additional considerations are the location of the tumor in the bladder, the multiplicity of the tumors, the involvement of lymph nodes, the invasion of the prostate, and infection and obstruction of the upper urinary tract.

Uretero-intestinal anastomosis is a very useful procedure in the prevention and treatment of upper urinary tract obstruction and infection, and it also permits more extensive surgical and radiation therapy for destruction of the tumor. It is most helpful in the palliative treatment of inoperable lesions. Transurethral resection was the most common form of treatment and was often quite satisfactory. When the tumor is located near the bladder neck anteriorly or in the fundus, it is difficult to destroy it adequately by this method, and partial cystectomy is considered the treatment of choice under these circumstances. Cautery through the open bladder has some advantages but is of no value in multiple tumors. Total cystectomy has become a relatively safe procedure, but it is possible that handling of the tumor may squeeze malignant cells into lymphatics or blood vessels. In deeply infiltrating carcinoma of the bladder, removal of the pelvic lymphatics may improve the results of treatment.

Irradiation was used in 112 patients. There was some evidence of improvement, but it seemed to be of little value as a sole means for destruction of the tumor. The limitations are due to the presence of tumors in such locations that adequate destructive irradiation cannot be applied to all portions of the neoplasms. In selected cases, such as multiple papillomas, intravesical application of radium may be valuable. Preoperative roentgen treatment to close off small vessels and lymphatics may greatly lessen the dangers of manipulation of the tumor at the time of partial or complete cystectomy.

It is stressed that treatment should be individualized for each patient.—*A. E. Childe, M.D.*

Williams, I. G. The use of radiotherapy in the treatment and management of inoperable carcinoma of the rectum. *Proc. Roy. Soc. Med.*, Dec., 1950, *43*, 1083–1086.

This contribution deals with the treatment of inoperable adenocarcinoma of the rectum. Squamous carcinoma of the anal canal is not included.

Radium therapy has extremely limited application, and the results of 200 kv. roentgen therapy have been so universally poor that their use, for the most part, has been abandoned. The author's cases were treated with 1 million volt therapy.

Severity of treatment: Almost all patients experience some symptoms of radiation sickness. After the second week of treatment, local reactions in organs lying in the path of the beam, radiation cystitis,

colitis and vulvitis, and toward the end of the treatment, skin reactions, add to the patient's discomfort.

Hazards of radiation therapy: These are due to late changes. Pelvic fibrosis may cause pain due to involvement of the sacral and lumbar nerves. The presence of tumor in such cases cannot be entirely excluded. Anal or rectal stricture may occur at the site of the growth. The complications of such stricture are chronic intestinal obstruction necessitating colostomy, chronic ulceration, or ureteral obstruction with hydronephrosis. Fistula may occur, the commonest of which is rectovaginal. Dermal radiation necrosis is a hazard of therapy which must be contemplated and a calculated risk assumed.

Eighty-four per cent of the cases were too far advanced for any form of surgery. Patients having operable lesions were not candidates for surgery for other reasons. The average age was sixty-two years.

Twenty-four per cent of 147 patients classed as Stage I, II, or III, in which the disease was still clinically confined to the pelvis, lived three years or more.

It is concluded that high voltage therapy can cause regression of primary tumors and alleviation of the symptoms of inoperable carcinoma of the rectum. This relief in a few cases can be long lasting providing a prolonged comfortable life. Adequate therapy is a severe trial for the patient, and unless carefully administered is capable of great harm. Repeated therapy is impossible, and for this reason radical therapy must be administered in the initial course of treatment. Skill in the application of this modality is essential with proper selection of cases.—*D. R. Bernhardt, M.D.*

RADIOISOTOPES

Holford, J. M. Some aspects of atomic medicine. *Proc. Roy. Soc. Med.*, Nov., 1950, *43*, 851–857.

The object of this paper is to draw attention to the various hazards in connection with the atomic bomb to which Service personnel are exposed.

Most damage by atom bomb explosion is caused by heat and blast. Military medicine is well acquainted with this aspect of atomic warfare, but injury by ionizing radiation is a novel problem.

The principal ionizing radiations known are α, β, and γ rays, roentgen rays, and neutrons. All are capable of producing the same effects on living cells, though their relative efficiency varies. The variation appears to be due to the different ways in which the ions are distributed in the cell. They all have one feature in common, however. Only about one-third of the total ionization is produced by the primary particle or radiation quantum. The remaining two-thirds are caused by electrons set in motion by the primary particle.

Tissue is radiosensitive in proportion to its reproductive capacity and inversely proportional to its degree of differentiation. Metabolic activity of tissue is a factor in its sensitivity to ionizing radiation. In ascending order of radiovulnerability human tissue may be considered: connective tissue, endothelial cells, epithelial cells, granulocytes, and lymphocytes. Muscle, bone and nerve cells are all highly resistant.

There is much interest in the effect of continuous or repeated exposure by the military services because of the conceivable need to use ground or equipment contaminated by radioactive products. A formula for predicting casuality rates among men over a period of several weeks' exposure is derived. To apply the formula it is necessary to know the rate of exposure and the percentage of casualties to be expected from exposing a group of men to a known instantaneous dose.

The relationship of radiation exposure and gonadal and genetic change is discussed. The possibility of producing mutant offspring and hereditary partial sterility are unsolved problems of atomic warfare.—*D. R. Bernhardt, M.D.*

Eichler, O., and Linder, F. Über die Bildung von Liquor im Lumbalraum, nachgewiesen mit Radionatrium. (Formation of cerebrospinal fluid in the lumbar space shown by radioactive sodium.) *Klin. Wchnschr.*, Jan. 1, 1951, *29*, 9–12.

Experiments with radioactive sodium (Na^{24}) show that in the dog there is not only a flow of cerebrospinal fluid from the cerebrum toward the cervical spine, but also a second type of flow from the lumbar region toward the cervical region. The authors believe that this proves that some of the cerebrospinal fluid is formed in the spinal canal. These experiments were done either by injection of a radioactive solution into the spinal canal and determination of its concentration with a Geiger counter; or a concentrated solution was injected intravenously and the spinal fluid was removed afterwards from different parts of the spinal canal.

Further experimental studies are being undertaken to confirm the authors' conclusions that cerebrospinal fluid is not only formed in the ventricles, but also in the region of the lumbar canal.—*H. W. Hefke, M.D.*

McCullagh, E. Perry, and Richards, Charles E. Radioactive iodine in the treatment of hyperthyroidism. *Arch. Int. Med.*, Jan., 1951, *87*, 4–16.

Early experiences during the past decade led to the abandonment of I^{127} and of the 12.5 hour isotope I^{130} for the isotope I^{131} which is now in common use for treatment of hyperthyroidism. In 1946 the uranium chain reacting pile made the eight day isotope easily available. The broadest use of this therapeutic agent has been for toxic diffuse goiter (Graves' disease). It has been found that the dosage for control of toxic nodular goiter has required increase by a

factor of 3 over that required in Graves' disease. This resistance to therapy plus the risk of a solitary nodule harboring a carcinoma curable by thyroidectomy has caused many to continue to prefer surgical therapy for hyperthyroidism of nodular goiter.

The authors report their experiences with treatment of 203 patients having diffuse goiters and hyperthyroidism. Only 4 of these patients were known to have continuing hyperthyroidism six months or more after treatment was begun. Less than 4 per cent have had recurrence of hyperthyroidism. Nineteen patients showed the only complication; namely, hypothyroidism and occasionally myxedema. These were controlled by desiccated thyroid or overcome spontaneously. Patients with high basal metabolic rates required 15 per cent greater dosages than those with low rates. Patients with large glands required 75 per cent larger dosages than those with small glands.

The series of 78 patients with nodular goiter treated by the authors contains 18 who still have hyperthyroidism. Much larger doses of I^{131} and longer time are required for nodular than for diffuse goiter with hyperthyroidism. One nodular goiter patient was hyperthyroid for nine months after a total dosage of 104 millicuries but was normal after fifteen months. It is stressed that one should not take a chance of treating hyperthyroidism associated with discrete adenoma by use of I^{131} in preference to surgery in a patient who is operable. It is doubtful that this same surgical rule applies equally to multinodular goiter in which some nodules are likely to remain after subtotal thyroidectomy. The latter group in the older age range was selected for I^{131} therapy in most instances in this series.—*J. W. Turner, M.D.*

Timmons, John R., and Timmons, James M. Lingual thyroid; the use of radioactive iodine in diagnosis. *Ann. Surg.*, Jan., 1951, *133*, 90–94.

The article discusses the increased efficiency of radioactive iodine as a means of determining the presence of lingual thyroid tissue, as compared to other methods.

It is pointed out that the biopsy methods of establishing the diagnosis are not completely satisfactory due to tendency to infection, inflammation and sloughing.

Two cases are presented, illustrating the use of tracer doses of radioactive iodine in establishing the presence of lingual thyroid tissue, and the presence or absence of thyroid tissue in the neck. The Geiger-Müller counter and measurement of urinary excretion of the iodine are employed.

Presence of lingual thyroid tissue results from the non-migration of the thyroid anlage from the foramen cecum region during embryologic development. Lingual thyroid tissue can show any pathologic change seen in the normally placed gland.

Various surgical methods of lingual thyroid removal are discussed. Because 70 per cent of cases with lingual thyroid show absence of thyroid tissue in the neck, thyroid insufficiency develops in a like percentage of cases following removal.—*Harry Flax, M.D.*

Clark, Dwight E., Trippel, Otto H., and Sheline, Glenn E. Diagnostic and therapeutic use of radioactive iodine. *Arch. Int. Med.*, Jan., 1951, *87*, 17–24.

This report reviews experience with I^{131}. The beta particles are spent within 2 mm. of their points of release in tissue and account for most of the biologic effect. The gamma rays reach the body surface and permit localization by Geiger-Müller counters. The eight day half-life is favorable. Sodium iodide in a weak alkaline solution is used.

In performing diagnostic studies, the mean urinary secretion of I^{131} was 25 per cent for thyrotoxic patients, 59 per cent for euthyroid patients, and varied from 75 to 95 per cent for hypothyroid patients. Diagnostic tracer doses of 40 to 100 microcuries gave readings after twenty-four hours as follows:

91% of euthyroid patients 10% to 35% uptake.
9% of euthyroid patients greater than 35% uptake.
94% of hyperthyroid patients greater than 35% uptake.
6% of hyperthyroid patients less than 35% uptake.

Test doses of 1.0 to 1.5 millicuries of I^{131} orally as inorganic radioactive iodine for conversion into plasma protein-bound iodine gave these diagnostic values:

Euthyroid 13% to 42%.
Hyperthyroid 45% to 96%.
Hypothyroid 10% and less.

For therapy of certain hyperthyroid patients (recurrent; with severe heart disease; after failure of propylthiouracil; and hyperthyroidism in older patients) 0.1 millicurie per gram of thyroid tissue is given initially, subject to supplementary doses bimonthly dependent upon response. Antithyroid drugs should be omitted for at least a month prior to I^{131} therapy.

For cancer therapy a dose of 35 millicuries has been used orally every two weeks. Treatment is continued until tumors with initial uptake of iodine no longer show localization on external survey with the Geiger-Müller counter. The desirability of preliminary ablation of the gland or destruction of it with I^{131} is stressed. Fifty patients were treated for cancer of the thyroid and 2 of these showed depression of the bone marrow after total doses of 600 millicuries. The blood improved after therapy was discontinued. Papillary adenocarcinoma and undifferentiated carcinoma gave poor results. Alveolar and follicular carcinomas of the thyroid with colloid formation showed better responses. The authors agree with the generally accepted opinion that about 15 per cent of unselected cases of thyroid cancer accumulate radioiodine suffi-

ciently for significant therapeutic effect.—*J. W. Turner, M.D.*

SHELINE, G. E., MOORE, M. C., KAPPAS, A., and CLARK, D. E. A correlation between the serum protein-bound iodine and the radioiodine conversion ratio in various thyroid states. *J. Clin. Endocrinol.*, Jan., 1951, *11*, 91–97.

Using I^{131} as an indicator, a conversion ratio of protein-bound radioiodine to total plasma radioiodine is correlated with the serum protein-bound iodine determined chemically in various thyroid states. Twenty-two euthyroid, 19 hyperthyroid and 4 hypothyroid individuals were studied.

Tracer doses of I^{131} from 0.05 to 0.2 mc. were given orally and twenty-four hours later blood samples were drawn for the determinations. For the conversion ratio the proteins from an aliquot of plasma were precipitated with 10 per cent trichloroacetic acid. After washing the precipitate with 1 per cent trichloroacetic acid, it was dissolved in dilute NaOH, dried, and the radioactivity determined with a Geiger counter. A similar aliquot of whole plasma was dried and also counted. Protein-bound serum iodine was determined chemically by the Chaney method with certain modifications of the authors. The details of this method are given.

In euthyroid subjects the conversion ratio ranged from 4 to 24 per cent and the serum protein-bound iodine from 2.7 to 6.4 micrograms per cent. The conversion ratio in hyperthyroids ranged from 33 to 100 per cent and the serum protein-bound iodine from 6.8 to 13.0 micrograms per cent In the hypothyroid individuals the conversion ratio varied from 4 to 25 per cent and the serum protein-bound iodine from 0.5 to 1.4 micrograms per cent.

The serum protein-bound iodine levels in the hyperthyroid subjects were all above the normal range. In this group the conversion ratios were above 40 per cent except in 3 instances and only 1 of these had a ratio below 35 per cent. In the euthyroid group no conversion ratio was above 35 per cent. There appeared to be no correlation between the conversion ratio or serum protein-bound iodine and the severity of thyrotoxicosis.

The authors conclude that the conversion ratio is of approximately equal value to the serum protein-bound iodine in differentiation of euthyroidism from hyperthyroidism. The conversion ratio, however, did not distinguish hypothyroidism from euthyroidism whereas the serum protein-bound iodine did. —*J. P. Storaasli, M.D.*

CHEMOTHERAPY

SHER, J. J., and HOWES, WILLIAM E. Thorium X treatment of skin epithelioma, keratoses, and delayed radiation changes. *Radiology*, Jan., 1951, *56*, 39–48.

Thorium X in alcoholic solution or ointment containing 150 to 300 microcuries per cubic centimeter or gram is described as an effective agent in the treatment of senile keratoses, superficial epitheliomas and radiodermatitis.

The thorium X solution is applied five successive times once a week. Two weekly treatments are sufficient for some keratoses, while most epitheliomas are eradicated following six weekly treatments.

The authors discuss the physical principles involved, describe the biological reactions to be expected and present suggestions as to the handling of thorium X.

Several case reports and five figures are included. —*E. E. Seedorf, M.D.*

WEDER, CARMAN, and BECKER, A. Cortisone in the treatment of leukaemia. *Canad. M. A. J.*, Jan., 1951, *64*, 39–42.

In a while male, aged 3½ years, a diagnosis of lymphatic leukemia was made. Nine hundred milligrams of cortisone was given in seventeen days. At no time was any reduction in size of spleen, liver or lymph nodes observed. No evidence of increase in erythroblastic activity was shown. The red blood cell count continued to fall and the reticulocyte counts remained low. No significant change was noted in the white blood cell pattern although a drop in the total white cell count from 15,000 to 1,600 was present. No clinical improvement or evidence of cortisone toxicity was observed.

The second case of lymphatic leukemia in a male, aged 2½ years, had a history of irritability, paleness, anorexia and increasing size of the abdomen, all of two weeks' duration. The spleen was enlarged medially to the midline and descended three fingers below the costal margin. Nine hundred milligrams of cortisone was given over a period of nineteen days. The hemoglobin continued to fall rapidly. A continued fall of the circulatory lymphocytic elements from 13,800 to 4,350 was found. No significant change in the white blood cell count pattern was observed although the cervical and axillary lymph nodes had disappeared. Slight diminution of the spleen and liver was noted on the tenth day of treatment. Autopsy showed marked leukemic infiltration of the liver and spleen as well as massive involvement of both kidneys and testicles.

In an adult (aged 44) with chronic lymphatic leukemia, a trial of cortisone therapy was begun with a dose of 50 mg. every six hours for a total of 1.3 gm. The full course of therapy was terminated by death on the sixth day of treatment. The treatment with cortisone did not alter the rapidly fatal course of the terminal phase of the disease.

In the last reported case of myelogenous leukemia in a child (age not stated), a course of aminopterin therapy was started but had to be discontinued, due to an inadequate response. He was carried along with

frequently repeated blood transfusions until cortisone became available. One gram was administered over a period of eighteen days (50 mg. twice daily) with blood count control. There was no evidence of clinical improvement with the cortisone. A falling hemoglobin and lack of increase in the reticulocyte counts would seem to indicate that no increase in erythroblastic activity attributable to the drug could be demonstrated. No reduction in the total white blood cell count nor any improvement in the cellular distribution of the leukemic elements could be ascertained.—*S. N. Tager, M.D.*

Bell, R. Edward, and Thomson, R. Kenneth. Treatment of leukaemia with cortisone. *Canad. M. A. J.*, Jan., 1951, *64*, 43–47.

In a case of acute lymphatic leukemia, that of a four year old female, 25 mg. of cortisone was given twice daily for two weeks, then once daily for another two weeks. The patient was discharged on her forty-seventh hospital day, in excellent general condition. One month later, however, she was readmitted with recurrence of lymphadenopathy and hepatomegaly. Thereafter her status deteriorated rapidly. The interesting features of the cortisone-induced remission which lasted only a few weeks were: (1) the dramatic reduction in the liver and lymph node enlargement; (2) the almost complete reversal of the bone marrow picture, and (3) the marked increase in platelets which reached almost 2 million after eight days of treatment.

In a case of subacute lymphatic leukemia in a four year old female with marked leukemic infiltration of the skin and skeletal involvement, cortisone therapy was started on the sixth hospital day. First a dose of 25 mg. and later 50 mg. was given twice daily until a total dose of 875 mg. was reached in eleven days. The clinical response was poor. The course was progressively worse until death occurred forty-three days after admission. There was a disappearance of the lymph node enlargement and of the leukemic infiltrations in the skin after the therapy was discontinued.

The difference in the response of these 2 cases is striking. What it may be due to, the authors are unable to state.

A case of acute monocytic (myelogenous type) leukemia was also treated by paying attention to the possible synergistic effect of cortisone and the folic acid antagonist, 4 aminopterolylglutamic acid (aminopterin). The case was that of a male, aged twenty-one, in whom bone marrow biopsy showed 50 per cent of the cells to be monocytoid cells, similar to those seen in the peripheral blood, and 14 per cent to be blast cells. One milligram of aminopterin was given daily. A satisfactory hematological response was obtained with a fall in the circulating leukocytes to 33,000 by the sixth day and a further fall to 13,800 in two weeks. After seventeen days' treatment with aminopterin, cortisone was started. A dose of 200 mg. of cortisone was given daily for two days, then it was increased to 600 mg. per day for two days, and finally to 1,000 mg. for one day. No further improvement was produced clinically. The cortisone was therefore discontinued. The patient died the following day.

The case illustrates the poor response obtained with cortisone in acute monocytic leukemia. Aminopterin and cortisone did not appear to have any synergistic effect. Although this patient was on a large dose of cortisone, the 17-ketosteroid excretion was not significantly altered. The explanation for this is not clear. Even with large doses of 600 mg. a day, no fall in the eosinophil count was noted.

Two other cases of undifferentiated leukemia, one in an adult, and one in a child were treated. In both cases a definite diagnosis as to type could not be made. The cortisone treatment in the first case was combined with aminopterin, and in the second case it was given alone.

In summary, 5 cases of acute leukemia (2 lymphatic, 1 monocytic, and 2 undifferentiated) were treated with cortisone; 3 were children and 2 were adults.

In some cases of acute lymphatic leukemia, cortisone may be of benefit although the remission produced is usually short. The drug is of little value in acute monocytic (myelogenous) leukemia, and in some cases of undifferentiated leukemia.—*S. N. Tager, M.D.*

Schullenberger, C. C., and Watkins, Charles H. Effects of nitrogen mustard on bone marrow in polycythemia vera. *Ann. Int. Med.*, Oct., 1950, *33*, 841–853.

The characteristic of nitrogen mustard in exerting its action to a greater extent on tissue cells having the highest rate of mitosis and to a lesser extent on those with a lower, or normal, rate of mitosis makes its use a rational approach to the treatment of such a condition as polycythemia vera.

Eleven cases of polycythemia vera treated with nitrogen mustard are presented. The program of treatment consisted of phlebotomy after diagnosis had been established. This was done to reduce the volume of packed erythrocytes to approximately 50–60 cc. per 100 cc. of blood. Sternal aspirations were then done and, after this, nitrogen mustard therapy was instituted. The latter was given intravenously in a total dosage of 0.4 mg. per kilogram of body weight, either in two injections or four injections on successive days.

A fairly detailed account is given of bone marrow changes noted initially, following phlebotomy, twenty-four hours after treatment with nitrogen mustard, and in some cases after a period of weeks to months after treatment was begun. Percentages are given of cell types in a total of 500 nucleated cells

in both erythroid and myeloid series. Myeloid:erythroid ratios are also discussed.

There were some indications that the effect of nitrogen mustard was proportionately greater on erythropoiesis than on myelopoiesis in these patients. Significant reduction in the percentage of normoblasts may occur within twenty-four to forty-eight hours, and may become marked from seventy-two to 120 hours after the initial injections of nitrogen mustard, with progressive parallel decrease of the most immature cells of the erythroid series. When the reduction in the percentage of normoblasts was most marked, it was seen to be a part of a general hypoplasia of the bone marrow, but significant reduction in the percentage of erythrocyte precursors may occur in the absence of marked general hypoplasia.

Clinically, 3 patients showed relapses three to five months after their initial treatment and received a second course of nitrogen mustard. Eight patients were in hematologic remission and free of symptoms at periods varying from two to fourteen months after their initial treatment. It should be pointed out that these results are not a criterion of what nitrogen mustard can do alone inasmuch as phlebotomy was also carried out in each case.

The authors hope that further investigation will make possible a plan of treatment for polycythemia vera, utilizing different dosage of nitrogen mustard and different dosage schedules, with the objective in mind of producing adequate depression of erythropoiesis without severe general hypoplasia of the bone marrow, thus increasing the safety with which nitrogen mustard may be employed in the treatment of this disease.—*G. J. Culver, M.D.*

SHUTKIN, NED M. Note on the use of nitrogen mustard in rheumatoid arthritis, with consideration of the similarity of its effect to that of cortisone and ACTH. *J. Bone & Joint Surg.*, Jan., 1951, *33-A*, 265–267.

Six patients with active rheumatoid arthritis showed prompt, but transient, improvement after the administration of nitrogen mustard. Nitrogen mustard is not recommended by the author as a therapeutic agent in rheumatoid arthritis. The unpredictability of the disease with its tendency to abrupt but temporary remissions, the possible beneficial effect of the rest and respite from responsibility occasioned by mere hospitalization, the misguided optimism of the arthritic who has already run the therapeutic gamut, and perhaps the unbridled enthusiasm of the investigator, all in the author's opinion, tend to compromise the validity of the findings.

Nitrogen mustard, he concludes, produces depletion of the cholesterol esters and ascorbic acid of the adrenal cortex in the experimental animal. ACTH likewise produces depletion of the cholesterol esters and ascorbic acid of the adrenal cortex. The similarity in biochemical and clinical response to ACTH and nitrogen mustard justifies further investigation of the latter agent in the therapy of rheumatoid arthritis.—*R. S. Bromer, M.D.*

HESTON, W. E. Carcinogenic action of the mustards. *J. Nat. Cancer Inst.*, Oct., 1950, *11*, 415–423.

In order to determine the carcinogenic capacity of known mutogenic compounds the authors studied the effects of nitrogen mustard and sulphur mustard in Strain A mice which carry an incidence of lung tumors.

Using nitrogen mustard, 32 Strain A mice, two months of age, were injected intravenously with 0.001 milligram of nitrogen mustard hydrochloride dissolved in 0.01 cc. of distilled water per gram of body weight at two day intervals for four injections. At the end of ten months those animals which survived (20) were sacrificed and their lungs examined for tumors. One hundred per cent of the animals had lung tumors and all had multiple nodules ranging from 5 to 16 in number, averaging 9 per mouse. In 32 control animals examined at twelve months, 20 (or 62.5 per cent) had lung tumors with nodules ranging from 1 to 3 in number with a mean of 0.81 per mouse.

A similar experiment was carried out giving a single larger dose to see whether or not a significant change occurred in the production of tumors when compared with the multiple-dose technique. The results, however, were not significantly different. Experiments carried out with sulphur mustard gave results similar to those of nitrogen mustard. However, the ability of the sulphur mustard to produce lung tumors in Strain A mice did not appear to be as great as nitrogen mustard.

In the discussion the authors mention briefly other carcinogenic compounds such as urethane and methylcholanthrene and emphasize that the increased incidence of lung tumors from these agents is comparable to the increased incidence produced by mustard when the doses of the various agents are kept at similar levels.—*J. P. Storaasli, M.D.*

WILKINSON, JOHN F. Treatment of acute leukaemia with aminopterin. *Lancet*, Feb. 10, 1951, *1*, 325–327.

Several folic acid antagonists have been tried in the treatment of acute leukemia. This report deals with 27 patients with acute myeloid, lymphatic, or monocytic leukemia which were treated with aminopterin. Six patients received small amounts, which were not considered a fair test of the drug. Of the remaining 21 patients, the treatment produced no response in 15, partial remissions in 4, and complete remissions in 2 for relatively short periods. A complete remission implies both clinical improvement and remission of the hematological condition.

One case is reported which demonstrated the ability of aminopterin to induce two dramatic complete temporary remissions. In each case of remission, however, a relapse soon occurred with the usual fatal termination.—*P. R. Dirkse, M.D.*

GLAUNER, W. Röntgenbildveränderungen bei Lungentuberkulose unter einem Kobaltkomplex. (Roentgenographic changes in pulmonary tuberculosis treated with a cobalt complex.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Dec., 1950, *73*, 713–718.

In a group of 18 cases with cavitation, treated by intravenous administration of the cobalt compound, 7, with thin-walled cavities, healed with no other medication or procedure. Two more healed with the addition of pneumothorax and lysis of adhesions. The other 9, with thick-walled cavities, showed some improvement.

Ten cases, without cavitation, showed marked improvement in the roentgenographic appearance, increase in body weight, decrease in sputum, disappearance of bacilli from the sputum, improvement of the blood picture, and marked decrease in the sedimentation rate.

The nature of the compound and the dosage are not stated. It was thought that changes in the cellular metabolism were probably responsible for the results, and it was stated that cobalt may decrease the amount of oxygen available for the tissues.—*J. J. B. Light, M.D.*

MISCELLANEOUS

SHANDS, A. R., JR., and STONE, FRANK P. A simple method for the direct projection of a section of a roentgenogram onto a screen. *Radiology*, Jan., 1951, *56*, 112–115.

A standard type of 1,000 watt bulb projection lantern with a device for conveniently interposing the roentgenogram between the light source and projection lens is described. The device consists of a 14 by 22 inch aluminum plate with a 3 by 4 inch aperture in the middle of its upper half. The projection lens and tube are removed from the lantern and are then fastened by screws to the aluminum plate in front of the aperture. The roentgenogram is held firmly against the plate opposite to the projection lens by two large rubber bands.

Protection of the film from the intense heat is furnished by either two ¼ inch pieces of blue heat-absorbent glass or by an ordinary laboratory jar filled with a blue solution of copper sulfate crystals. The detail of the enlarged roentgenographic image on the screen is found to be excellent provided the original roentgenogram is satisfactory.—*E. M. Cooper, M.D.*

RUSHMER, ROBERT F., BARK, RAYMOND S., and HENDRON, JOHN A. Clinical cinefluorography. *Radiology*, Oct., 1950, *55*, 588–592.

An apparatus for cinematic recording of fluoroscopic images for clinical application is described. Exposure of the patient to radiation has been decreased by accurate synchronization of the 35 mm. camera and the roentgen-ray machine. The use of ignitron contactors permits exposure of each frame to light generated by four pulses of roentgen-ray with the flow of current interrupted during the next four pulses while the film is advanced.

The description of the apparatus is supplemented by two photographs and two drawings.

The improved equipment is ideal for specialized studies of the circulation in health and disease.—*A. W. Sommer, M.D.*

GERSHON-COHEN, J., and COOLEY, A. G. Telognosis. *Radiology*, Oct., 1950, *55*, 582–587.

The term "telognosis" is used to abbreviate the three terms—"teleo roentgen diagnosis"—indicating roentgenographic diagnosis obtained from fascimiles of original roentgenograms, transmitted by radio or telephone wires. The system described has been in operation for two years and has been used to transmit facsimiles over a distance of 28 miles. Excellent detail of the facsimile is claimed, and operation has been satisfactory and trouble free.

The apparatus is described in detail and a diagrammatic illustration is given.—*A. W. Sommer, M.D.*

BUTLER, GEORGE V. The inverted position in roentgenography. *Radiology*, Jan., 1951, *56*, 66–72.

Frequently during roentgenographic or fluoroscopic examination, tilting the head down as much as 90 degrees may aid in diagnosis, and the author describes a special suspension garment which is convenient and allows for full rotation of the patient. All degrees of the Trendelenburg position have been tried, and 50 degrees appeared to be suitable for most examinations.

Such a position aids in fluoroscopy: of the esophagus by slowing the flow of barium, accentuating the esophageal ampulla, and in diagnosis of a diaphragmatic hernia; of the stomach by obtaining a double contrast effect in the pylorus and duodenal cap, and by retrograde flow of barium into a diaphragmatic hernia; of the small bowel by helping to separate loops of ileum; and of the colon by the re-distribution of air during air studies. Better filling during intravenous pyelography is obtained from use of this position and the aid of an inflated Foley catheter in the rectum.

No contraindications to the use of this position

were found for ambulatory patients.—*M. B. Goodwin, M.D.*

FREED, JOHN H., PENDERGRASS, EUGENE P., and RAUFER, HENRY. Use of autoradiographs to detect defects in radium needles and tubes and inequalities in the distribution of the radium. *Radiology*, Jan., 1951, *56*, 99–103.

Dosage calculations in radium therapy are based on the assumption that the radium sources used are free from defects and that the radium is uniformly distributed along the active length of the source. Badly packed needles, damaged containers permitting leakage of radium, and faulty distribution of the radium may produce considerable discrepancy between the expected tissue dose and the dose actually delivered. This indicated a need for periodic study of the radium sources to be certain that they are free from defects, uniformly packed and of the stated strength and filtration designated by the manufacturer.

A simple method of making radioautographs of radium needles and tubes is described. Illustrations of defects and inequalities of radium distribution discovered by this method are presented. A technique for producing satisfactory radioautographs is described and a suitable formula, which can be used as a guide for determining the exposure time required for various tubes, is given.—*A. W. Sommer, M.D.*

RAVENTOS, ANTOLIN, and SCHWARZ, GERHART S. Penumbra effect in therapy cones. *Radiology*, Jan., 1951, *56*, 84–88.

Most deep roentgen therapy cones are constructed with light, thin, sheet metal side walls and a collimating lead diaphragm at or near the tube end. The field delimited by this collimating diaphragm is not of uniform intensity due to the fact that the focal spot, from which the rays originate, is not a single point but an area of considerable size. As a result the skin portal consists of a central zone of full intensity surrounded by a penumbra zone of partial intensity.

Using cones commercially available, studies were made and isodose curves determined for the area covered by each cone. Because of the marked inequality of intensity throughout the treatment portal found in many of these cones it is advised that radiologists investigate the entire field and the adjacent areas for each cone they use. Either film-blackening effect or actual ionization measurements may be used.

Several methods for obtaining uniform intensity to the treatment field are discussed. A description is given of an "umbrella" cone which is proposed as a solution to this problem. This is essentially a cone with a lead diaphragm in its usual location, but with an aperture larger than its purely geometrical requirements, placing the penumbra entirely outside the treatment portal. To absorb the penumbra radiation which escapes through the radiotranslucent walls of the cone, a lead "umbrella" is attached to the cone near its distal end. The umbrella is a lead diaphragm with flanges extending beyond the walls of the cone. The aperture and the distance of this diaphragm from the skin are adjusted so that a uniform intensity is obtained in a well confined treatment field.—*A. W. Sommer, M.D.*

HUNTER, F. T., and ROBBINS, L. L. The protection of personnel engaged in roentgenology and radiology; final report. *New England J. Med.*, Jan. 4, 1951, *244*, 9–13.

This is a final report on the information obtained in monitoring roentgen-ray personnel at the Massachusetts General Hospital. A preliminary report was made in 1949. Film-badge monitoring was found to produce a good psychological effect on the persons wearing the badges. The resident doctor beginning his training was impressed at the start with the fact that there was a definite danger to be considered. Sometimes beginners do not become aware of this fact until several months have gone by. The beginner in fluoroscopy, for instance, tends to use the fluoroscope longer and keep the shutter opened wider than is necessary. Nurses and technicians also become more aware that they are in a hazardous occupation. Since monitoring was instituted they are more careful not to walk through a room in which a patient is being roentgenographed, and more apt to avoid being in a room when an exposure is made. Film-badge monitoring has also resulted in certain technical improvements, with the gap in the fluoroscopic table being corrected by some manufacturers.

An attempt was made to correlate the amount and quality of radiation received with changes in the peripheral blood picture over a long period. Three arbitrary criteria were chosen as the limits of normal: leukocyte count between 6,000 and 10,000; a polymorphonuclear percentage not less than 60; and an eosinophil percentage not above 3. Statistical graphs are presented. It was concluded that the individual deviations from the normal blood picture, which had caused some anxiety in the past, were unrelated to roentgen exposure. Because of this and the fact that all personnel studied are now subject to exposures far below the effective biologic level, it was decided to conclude this special study.

The authors suggest that radiation monitoring should be a function of government health agencies. It is pointed out that few hospitals, and almost no radiologists in private practice, have the facilities for carrying out such a monitoring program. Employees in a number of industries and trades are likewise subject to radiation exposure. It is contended that public health departments are, or should be, primarily responsible for preventive measures that the worker cannot perform himself. The industrial hygiene divi-

sion of a state health department would seem to be the logical agency for this function.—*D. S. Kellogg, M.D.*

Ingram, M., and Barnes, S. W. Experimental confirmation of a previously reported unusual finding in the blood of cyclotron workers. *Science*, Jan. 12, 1951, *113*, 32–34.

This experimental work is a follow-up on a previous report in 1949. In the earlier paper the authors reported the occurrence of lymphocytes with bilobed or double nuclei in the blood of personnel associated with the 130 inch cyclotron at the University of Rochester. The cells were noted after exposures which were believed to be well below the accepted tolerance levels.

Hematological studies were made on 3 healthy mongrel dogs under control conditions, and under conditions of relatively slight exposure. For the latter, the dogs were stationed in relatively protected positions outside the cyclotron building for thirty minutes at a time on three occasions. There was an interval of six weeks between the first two exposures, and ten weeks between the second and third. The animals were roughly 50 feet from the target, at about the level of the tank, and well outside the neutron beam. Blood smears were made at regular intervals, and clearly demonstrated a marked increase in the occurrence of lymphocytes with bilobed nuclei after the exposures. It is pointed out, however, that this type of cell has been observed in certain infections diseases of childhood, infectious mononucleosis, lymphatic leukemia, etc. The general condition of the individual must be carefully evaluated.

Perhaps the most significant aspect of these observations is the fact that the cells occur following extremely small exposures that do not produce changes detectable by routine hematological examinations. For this reason, studies of the occurrence of lymphocytes with bilobed nuclei appear to be an unusually promising means of identifying potentially harmful operations before gross overexposure can occur. It is not known which component or components of the radiation are responsible for the "bilobed nucleus response," but further study is being made to determine this. In the authors' experience this response is less prominent in persons working with the 26 inch cyclotron and with radioactive isotopes than in those associated with the 130 inch cyclotron.—*D. S. Kellogg, M.D.*

Takata, Maki. Über das gesetzmässige Verhalten der Flockungszahl bei der Bestrahlung des Menschen durch Röntgenstrahlen. (On the lawful behavior of the flocculation count in irradiation of man with roentgen rays.) *Radiol. clin.*, Jan., 1951, *20*, 21–33.

Notwithstanding the fact that considerable progress has been made in the study of the laws governing the ionization of gases and air produced by roentgen irradiation, the vital ionization of the tissues continued to remain an obscure problem of little practical application.

The "flocculoreaction count" of the serum which bears the author's name was first introduced by him in 1935 as a "titration method of the ions" to determine the intensity of the "vital" ionization produced in man during roentgen irradiation. Since then, Murasugi has carried out, under the author's leadership, a series of experiments to find out if some lawful relationship could be established between the "vital" ionization and the quality of the roentgen rays used for the irradiation.

In this article, which is dedicated to Professor Hans Staub on the occasion of his sixtieth birthday, the author describes the present status of the work by giving numerous data and curves indicating the results obtained so far.

It is assumed that in the living tissues, in a manner similar to that of air, photoelectrons as well as Compton electrons are being produced, the latter giving rise to secondary and tertiary electrons, depending on the energy of the primary roentgen beam. Thus a widespread vital ionization takes place which is dominated by the Compton effect as the hardness of the beam increases. In other words, the vital ionization, at least theoretically, has the same underlying mechanism as the air ionization.

The physical measurement of the air ionization is comparatively easy, but obviously a similar procedure cannot be applied for the measurement of the vital ionization. The author conceived the idea that the particles arising in the process of the "flocculoreaction" of the serum could be counted, and since this reaction is dependent on the radiation administered, the procedure could be used to determine certain phases of the vital effect of the irradiation. The details of the procedure have been described in the *Helvetica medica acta*, 1950, *17*, 254.

In man the vital ionization occurs at the site of irradiation, as, for example, in the abdomen, head, or extremities. The locally produced ions then immediately enter the blood circulation and are carried to the rest of the body. The ionization can be determined by obtaining blood from the cubital vein (about 5 cc. every 5 to 10 minutes) and by counting the flocculation particles of each blood specimen. The vital ionization is then determined by the following formula:

$$\mathcal{J}' = Flc_x - Flc_0$$

in which $\mathcal{J}'$ means the vital ionization, Flc_0 the flocculation count immediately prior to the start of the irradiation, and Flc_x the flocculation count values at certain intervals of the irradiation. The vital ionization in any living organism is variable so that the maximum value has been reached immediately at the end of the irradiation, and within ten minutes

there is a return to the initial value prior to the irradiation. The flocculation count values after and prior to the irradiation are therefore nearly always equal.

The flocculoreaction count was determined by irradiating (1) with roentgen rays of 100, 110, 120, 130, 140, 150, 160, and 170 kv., always using an 0.5 mm. Cu filter with various distances and different sized fields, and (2) with gamma rays of radium (100 mg. radium intravaginally).

It was found that the vital ionization ($\mathcal{J}'$) in general follows the same laws as the air ionization, *i.e.*, it is proportional to the square of the tube voltage, indirectly proportional to the square of the distance, and directly proportional to the field size.

In regard to the dependence on the intensity and quality of the irradiating beam, it may be said that the flocculoreaction count (1) is a function of the intensity of the primary beam, and (2) is comparatively greater with hard rays than with soft rays, indicating a certain wavelength dependence. This latter observation is contrary to the more or less generally accepted view, according to which the biologic effect of the roentgen rays is grossly independent of the quality of the roentgen beam.

In concluding, the author emphasizes that in radiation therapy there is a great necessity for a biophysical unit. With the aid of the flocculoreaction count the investigations of the biologic effect of the irradiation will assume increasing importance.—*T. Leucutia, M.D.*

Hoecker, Frank E., and Roofe, Paul G. Studies of radium in human bone. *Radiology*, Jan., 1951, *56*, 89–98.

Animal experiments and experience with human beings have shown that a portion of any quantity of radium which enters the body will be deposited in the bones. Osteogenic sarcomas are often associated with small quantities of radium which have been fixed in the bone for considerable periods. It is usually assumed that the biochemical history of radium in the body is similar to that of calcium. Experimental evidence has been found that the metabolic behavior of radium is not in all respects similar to that of calcium.

This report is to illustrate and describe certain characteristic patterns of radium distribution in the matrix of human bones, to correlate these with the microscopic structure of bone and to evaluate, approximately, the tissue dosage associated with a few typical radium concentration patterns.

Portions of bones from 2 cases of osteogenic sarcoma attributed to radioactive substances were examined microscopically and radioautographically. The radioactive substances were found to be concentrated in numerous microscopic locations. Maximum density of radium in these locations varied by a factor of about 1.5 from one type of bone to another. Frequency of occurrence of these localizations varied by a factor of about 25. Mineral residue of the sarcoma of one case contained only a negligible amount of radium. This is believed to indicate that radium was not mobilized from other portions of the body.—*A. W. Sommer, M.D.*

Salisbury, Peter F., Rekers, Paul E., Miller, Joseph H., and Marti, Norman F. Effect of early cross transfusion on x-irradiation disease. *Science*, Jan. 5, 1951, *113*, 6–7.

The article presents the results of investigation of possible protective and regulatory factors of cross transfusion in the reduction of the nonspecific toxicity of massive doses of radiation.

A brief discussion is made of the use of parabiotic animals in demonstrating the lack of indirect effects which are peculiar to radiation alone.

A group of 25 dogs were given total body roentgen irradiation. Part were cross transfused, the remaining formed a control. Eighty-four per cent of the control group succumbed, 33 per cent of the transfused dogs died.

Two charts are presented showing less depression of leukocyte count and reticulocyte response in the transfused group than in the control group.—*Harry Flax, M.D.*

Frank, Josef. Zur Feststellung schädlicher Strahlung. (Demonstration of harmful radiation.) *Strahlentherapie*, 1951, *84*, 147–153.

The roentgen meter described visibly demonstrates the intensity of radiation about roentgen-ray and radioactive installations. It was designed to present *visible* evidence of the radiation so that operating personnel would be more impressed and therefore more careful about becoming exposed to such radiation.

The instrument is described as simple, effective and cheap. It consists of a rotating electroscope so arranged in a wooden ionization chamber that a mirror attached to the electroscope reflects a beam of light onto a scale. The deflections of the beam measure the intensity of the radiation. A radium preparation is included in the instrument to serve as a control.

The instrument is described in considerable detail. A photograph and diagram help demonstrate its construction.—*H. G. Moehring, M.D.*

Olsson, Olle. Antihistaminic drugs for inhibiting untoward reactions to injections of contrast medium. *Acta radiol.*, Jan., 1951, *35*, 65–70.

The author states that untoward reactions to intravenous injections of contrast media administered in connection with urography are common. They consist of coughing, sneezing, nausea, and urticarial eruptions. In addition, shock and sometimes death has occurred.

Antihistaminic drugs have been employed in the treatment of many kinds of hypersensitive reactions, and therefore this study was undertaken to try the value of antihistaminic drugs in the prophylactic treatment of untoward reactions to contrast media. The investigations were carried out in adults. In the first series of cases the antihistaminic substance used was antasten (Ciba) and 2 ml. was injected subcutaneously or intramuscularly thirty to sixty minutes before the intravenous administration of the contrast medium. The contrast media used were Diiodon "Leo" and umbradil "Astra" which, according to the author, is identical with diiodon but made by another manufacturer.

Later, to avoid the necessity of 2 injections, a series of cases was given the contrast medium mixed with the antihistaminic substance. In these tests, desentol "Leo" (benadryl) was mixed with 20 mg. of diiodon "Leo" 35 per cent (diodrast) and this mixture was called diiodon D.

In the conclusions it is brought out that reactions to contrast media deposited in the blood stream are not uncommon. The administration of an antihistaminic substance simultaneously with the dye essentially decreases the occurrence of reactions. However, the antihistaminic agent was not able to control *all* allergic reactions.

The favorable effect of premedication with antihistaminic drugs was most evident in the cases in which the same patient received injections of different contrast media at repeated urographic examinations. For example, this series included a number of cases in which the patients were being followed roentgenologically for renal tuberculosis. Many of these had considerable trouble after the injection of ordinary contrast media but felt no discomfort after the injection of diiodon D. All those cases in which repeated injections were made with different media showed, without exception, that diiodon D was followed by fewer untoward reactions than were ordinary contrast media.

Also, repeated injections of diiodon D in one and the same patient had no effect on the tolerance of the patient to the contrast medium.

Observations made in this investigation thus justify the incorporation of an antihistaminic drug in contrast media or else premedication with an antihistaminic drug. The prophylaxis of shock occurring in connection with injections of a contrast medium ought to include medication with some antihistaminic substance. A dose of 20 mg. has been found suitable.

Since the prophylaxis did not completely control all allergic reactions, the author advises that a search be made for a new contrast medium.—*Mary Frances Vastine, M.D.*

Janker, R. Die Röntgenkinematographie, ein Mittel zur Ausbildung in der Röntgen-Diagnostik. (Roentgen cinematography—a means of teaching roentgen diagnosis.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Dec., 1950, *73*, 652–669.

The usefulness of roentgen cinematography for the teaching of roentgen diagnosis and for detailed study of complicated and rapid movements is demonstrated. Moving pictures of the act of swallowing or of angiocardiography can be viewed in slow motion or pertinent stills copied from the film strip and studied at leisure. The author has employed and developed this method for twenty-five years. Examples from his teaching films are shown in excellent reproductions: normal act of swallowing, act of swallowing in a case of cleft palate, Zenker's diverticulum, carcinoma of the esophagus, gastroenterostomy, aortogram in endarteritis obliterans, angiocardiography in normal and in a case of tricuspid valve atresia.

The technical details are not discussed.—*F. M. Reis, M.D.*

Leonard, Morton H., Breck, Louis W., Basom, W. Compere, and Loseff, Herbert S. Simple adapter for mounting head of x-ray tube to fracture table. *J. Bone & Joint Surg.*, Oct., 1950, *32-A*, 950–952.

An adapter for mounting the head of a portable roentgen tube to the fracture table so that the tube head can be moved in three directions is described in this paper. It has been found by the authors to be a successful and facile way of securing good roentgenograms in the lateral projection during hip pinning.

A brass adapter cylinder is designed to receive the upright on one of the commercial shock-proof tube heads. The bushing is placed in the hole at the foot of the table ordinarily used to install the table upright. The cylinder and its use with one of the commonly employed tables is illustrated in the article. For another commonly employed table, a box-like contrivance is clamped on the lower parallel bars. It carries a socket to receive the upright of the tube. These devices permit mounting the head of the roentgen tube, with mobility in all planes, to either type of table. An adapter similar in principle can be made for other fracture tables.—*R. S. Bromer, M.D.*

Nordenström-Blomqvist, Björn E. W. An attempt of excreting injected thorotrast in rabbits by 2,3-dimercaptopropanol (BAL). *Acta radiol.*, Dec., 1950, *34*, 533–545.

British antilewisite (BAL) is 2,3-dimercaptopropanol and has the ability to increase the excretion of arsenic. Therefore, it has been found to act as a detoxifier in cases of arsenic poisoning. It is also applicable in poisoning with other heavy metals, *viz.*, gold, mercury, lead, chrome, nickel, antimony and bismuth. BAL is also effective in thallium and selenium poisoning.

Since thorium is, in certain respects, related to lead and since it is stored by the same organs the author performed experiments in rabbits which were injected with thorotrast. In order to determine whether the excretion of thorotrast was increased by this drug, the urine was collected daily and its radioactivity was measured. Thorotrast is made up of 25 per cent thorium dioxide in a stable emulsion. The alpha activity in 25 ml. of thorotrast is equivalent to 0.5–1 microgram of radium. The gamma activity in 75 ml. of thorotrast has been determined to be equivalent to 1.37 micrograms of radium.

The following results were obtained:

1. No excretion of thorium in the urine was found.

2. The radioactivity in the urine consisted of disintegration products of thorium of which one short-lived element, probably thorium X, and one long-lived element, probably mesothorium I, were excreted.

3. After an intravenous injection of thorotrast in rabbits no increased radioactivity in the urine after BAL treatment was noted (nor after BAL plus NH_4CL).

4. The radioactivity in the urine the first day after the injection of 1 ml. of thorotrast per kg. of body weight was three to four times as high as that noted the days following. The value then remained constant as long as one and a half months after the injection.

5. There was no significant difference in the remaining radioactivity in the liver, spleen, kidney and yellow bone marrow of the BAL-treated animals, and the untreated control animals.

6. The spleen showed a radioactivity four times as high as the liver (measured on the gamma-intensity per gram). The kidney showed an apparent low radioactivity per gram fresh weight in comparison with that of the liver and spleen.—*Mary Frances Vastine, M.D.*

ZADEK, I. Spätschädigungen durch Radiothorium. (Late injuries from radiothorium.) *Strahlentherapie*, 1950, *83*, 59–66.

This general topic is reconsidered because the lessons learned from the use of naturally radioactive substances in animals and humans can as well be applied to the use of radioactive isotopes (and it seems that such radioactive isotopes will become available for medical use in Germany).

Radiothorium, a decay product of thorium, is an alpha- and beta-emitter with a half-life of 1.9 years. Its decay product, thorium X, has a half-life of 3.64 days. Radiothorium is metabolized much like iron and is thus stored in the liver, spleen and lungs—but not in the bone marrow. In contrast, thorium X (like radium) is a homologue of calcium and lodges in osseous tissue; thus is in close contact with the hematopoietic system.

A single injection of 1.0 electrostatic unit of radiothorium per kg. of body weight is the maximum non-fatal dose. Even this dosage produces weight loss and leukopenia of long duration. The deleterious effects of radiothorium consist of connective tissue proliferation and nuclear degeneration in parenchymal cells of the hepatolienal system and the lungs, plus extreme depression of hematopoiesis. Late injuries also include the development of malignant neoplasms, and cachexia with lowered resistance and secondary diseases.

To remain free of undue hazard, therapy with radioactive substances must be planned on the basis not only of dosage, but also of the chemical structure, half-life, mode of excretion, effect on blood and metabolism, and tissue affinity of the agent.—*H. G Moehring, M.D.*

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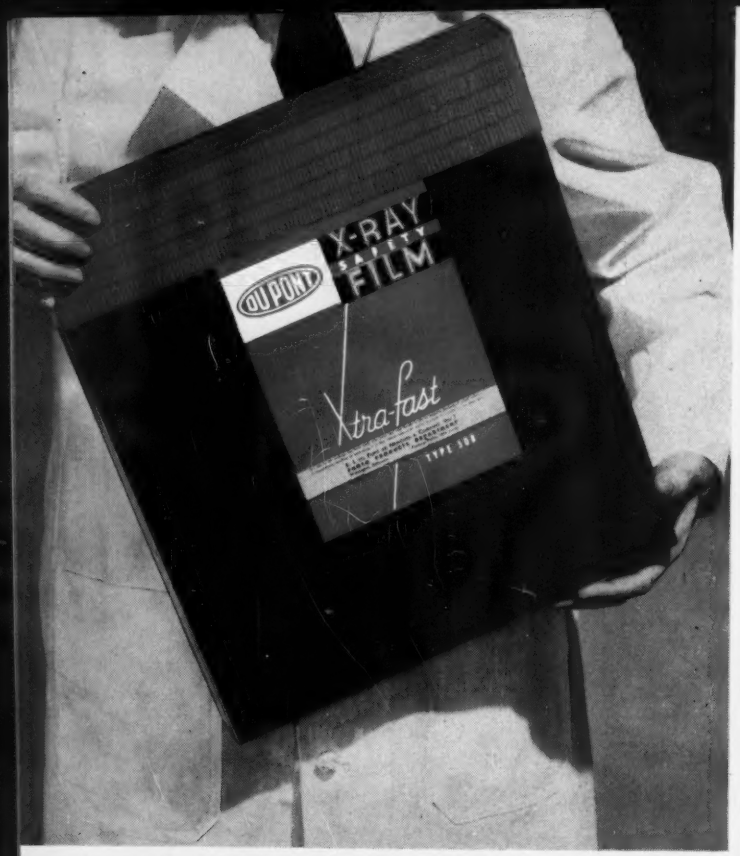

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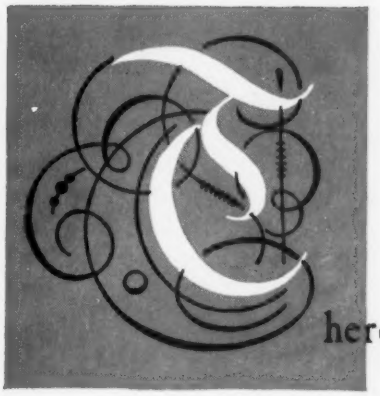

here was once a very wise man

who, living atop a high mountain,
could see for great distances.

One winter's day a strong, young
man climbed long and hard
and came unto the wise man
and asked:

"In your wisdom, what would you
most wish
for all men
in this season?"

The wise man held his gaze
at a very great distance
and replied:

"I would wish that every man
might live so that
the warmth and charity
of this season
should be with him
throughout his years."

We, at Westinghouse, send you our
Season's Greetings

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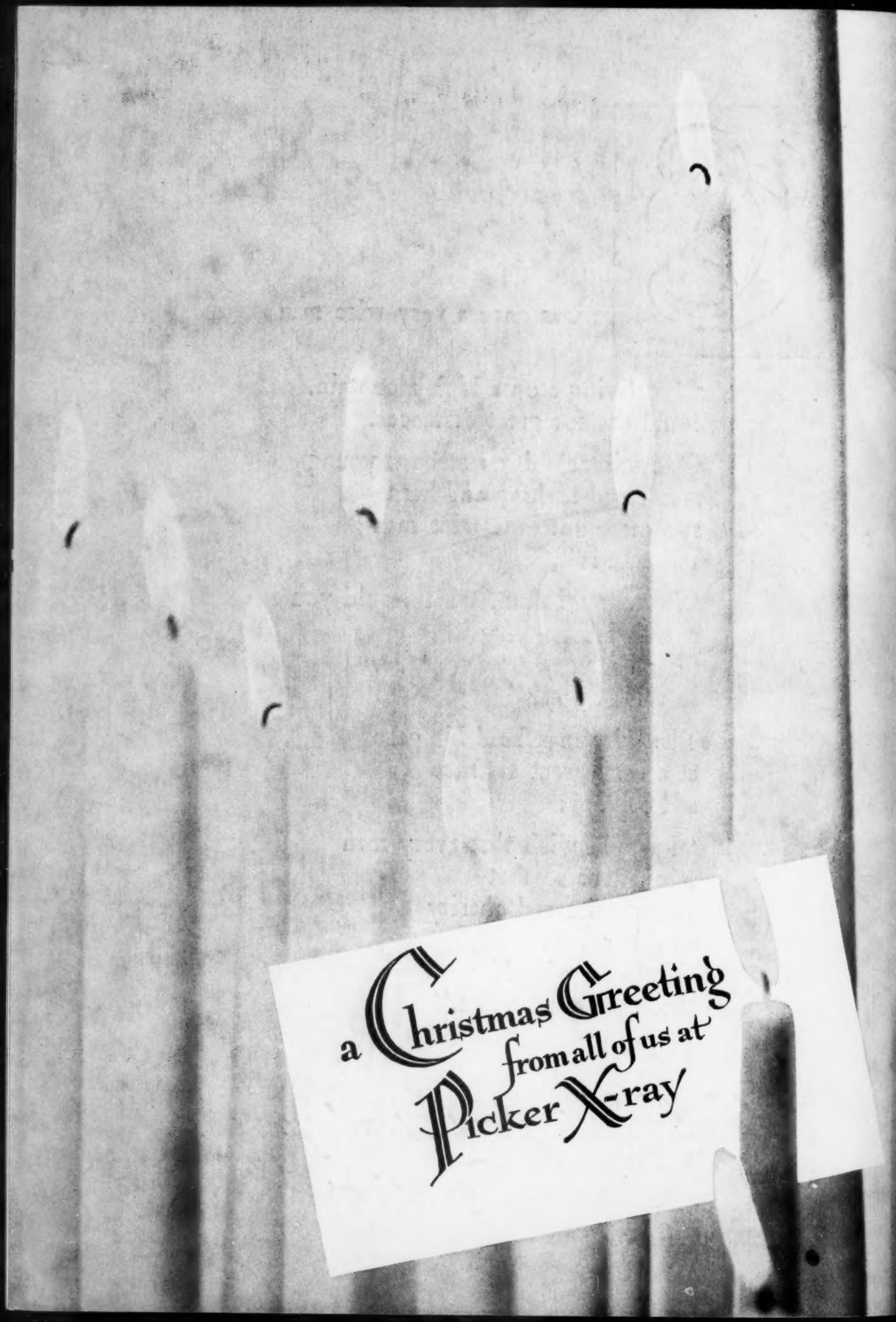
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